

PACIFIC COAST NUMBER

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SEATTLE

MOTORSHIP

Devoted to Commercial and Naval Motor Vessels

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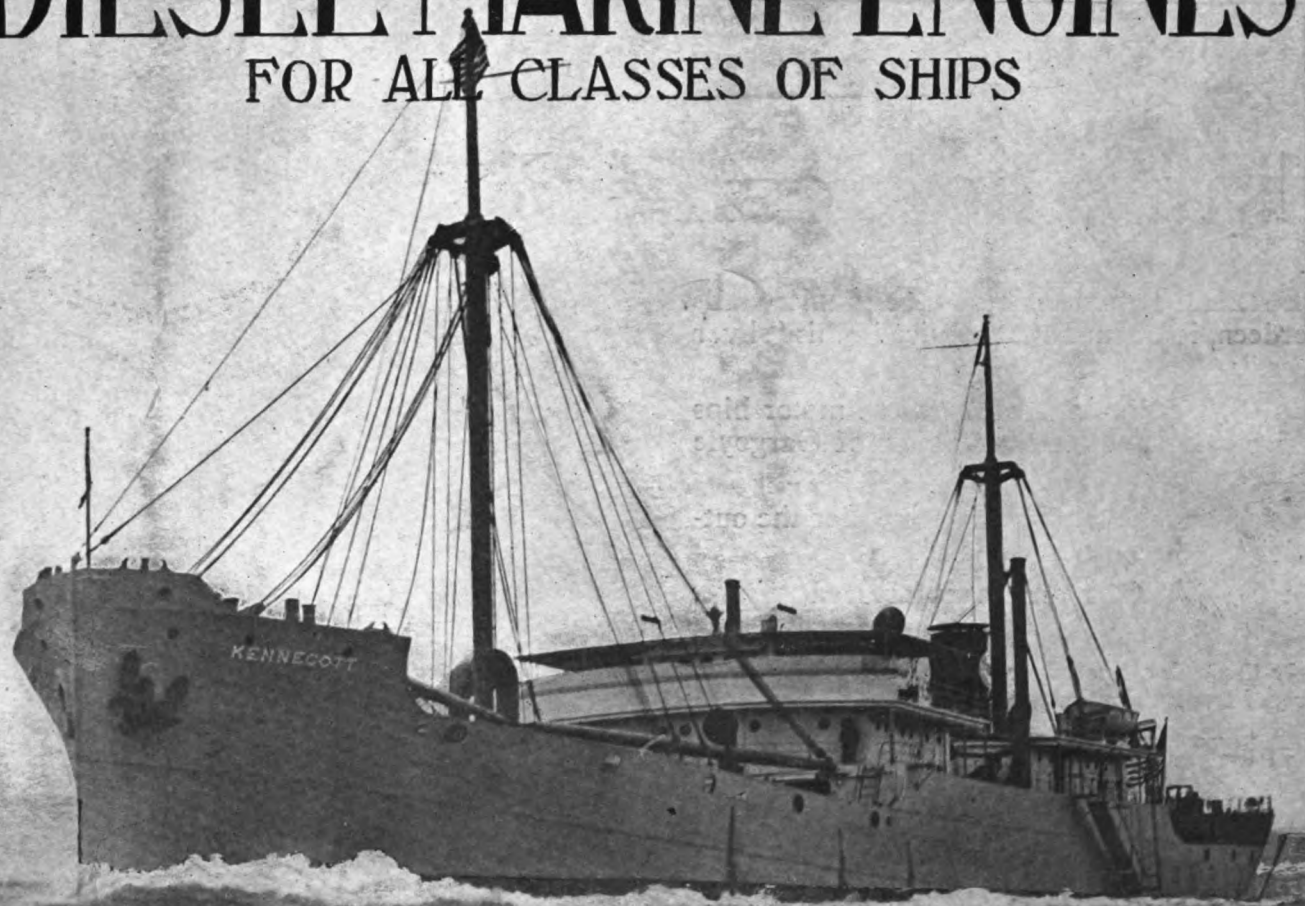
AUGUST, 1921

Vol. 6 No. 8

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DIESEL MARINE ENGINES

FOR ALL CLASSES OF SHIPS



McINTOSH & SEYMOUR CORP.
AUBURN N.Y.U.S.A.

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Vol. VI

New York, U. S. A., August, 1921
Cable Address—Freemote, New York

No. 8

Sink 1,000 Steamers or More

Suggestions to Chairman Lasker of the Shipping Board

By IMPORTER AND EXPORTER

YOUR great problem, Mr. Lasker, is to stop the flow through the broken dam. Nearly \$200,000,000 a year is pouring through the break. The little Dutch boy who stuffed a finger into the hole in the dyke to prevent the trickle of water enlarging a passage, which the wild North Sea would use to break the dyke and flood the land, lost his hero life to save a waste of other lives and property.

That boy had the makings of a Harriman. Wasn't it Harriman who piled the loaded freight trains into the break in the dam to stem the waters that defeated every effort of the engineers to rebuild the work?

Why not sink 1,000 worthless steamers or more to hold back the flood of money pouring to waste through the Shipping Board? You are getting on the right track. You told the reporters the other day that what we had spent on the building of our ships was money we had already dug out of our pockets, but every dollar short on the operation of the fleet has to be made good by taxes we still have to pay. In the usual phase, this is throwing good money after bad!

Why ask the nation to bear taxes for the maintenance of a lot of junk? You don't have to go over the Shipping Board Fleet with a fine haircomb to discover there is a lot more junk than the million tons of wooden vessels.

There is a lot of junk in the 10,000,000 tons of steel steamers. Why not admit it now? There is no magic in steel. Steel does not of itself make a good ship. With the right design and the right care and workmanship steel can be formed into a good hull. Yet even a good hull does not make a merchant vessel. You have to get the right ma-

chinery. And how much good machinery do you have in the whole Shipping Board Fleet?

Shippers of merchandise are skeptical about Shipping Board steamers. They have to be shown. Cargoes delayed through steamer repairs and shipments spoiled through the same cause or through salt water were commonly spoken of until the time when the laying-up of the steel vessels permitted the vessels in service to be handpicked. A large number of those now laid up ought never to be put back into service; they ought not to have another dollar spent on them; they ought to be scuttled and sunk.

There are about 650 Shipping Board vessels in operation. Some of them are first-class vessels, particularly those built in the old established yards. Many of them, however, are outclassed for general service. They are too expensive to operate; they cannot make money in competition with the foreign ships, and they will be a losing proposition long after the foreign vessels are profitably operating again. Sink them. We paid for them, as we paid for aeroplanes, tractors, guns and many other things in the stress of war. But don't let us waste money on them in peace.

When General "Hell and Maria" Dawes was winding up the business end of the A. E. F. in France he made a deal with the French Government that saved us a lot of money. He sold the army supplies "as is, where is and what is" for \$400,000,000. Most people thought it a poor deal,

because the supplies had cost \$1,500,000,000 or more. Time has proved that Dawes was right. The British army haggled over the terms of sale, and as a result, millions and millions of dollars worth of British supplies lie rotting in France today.

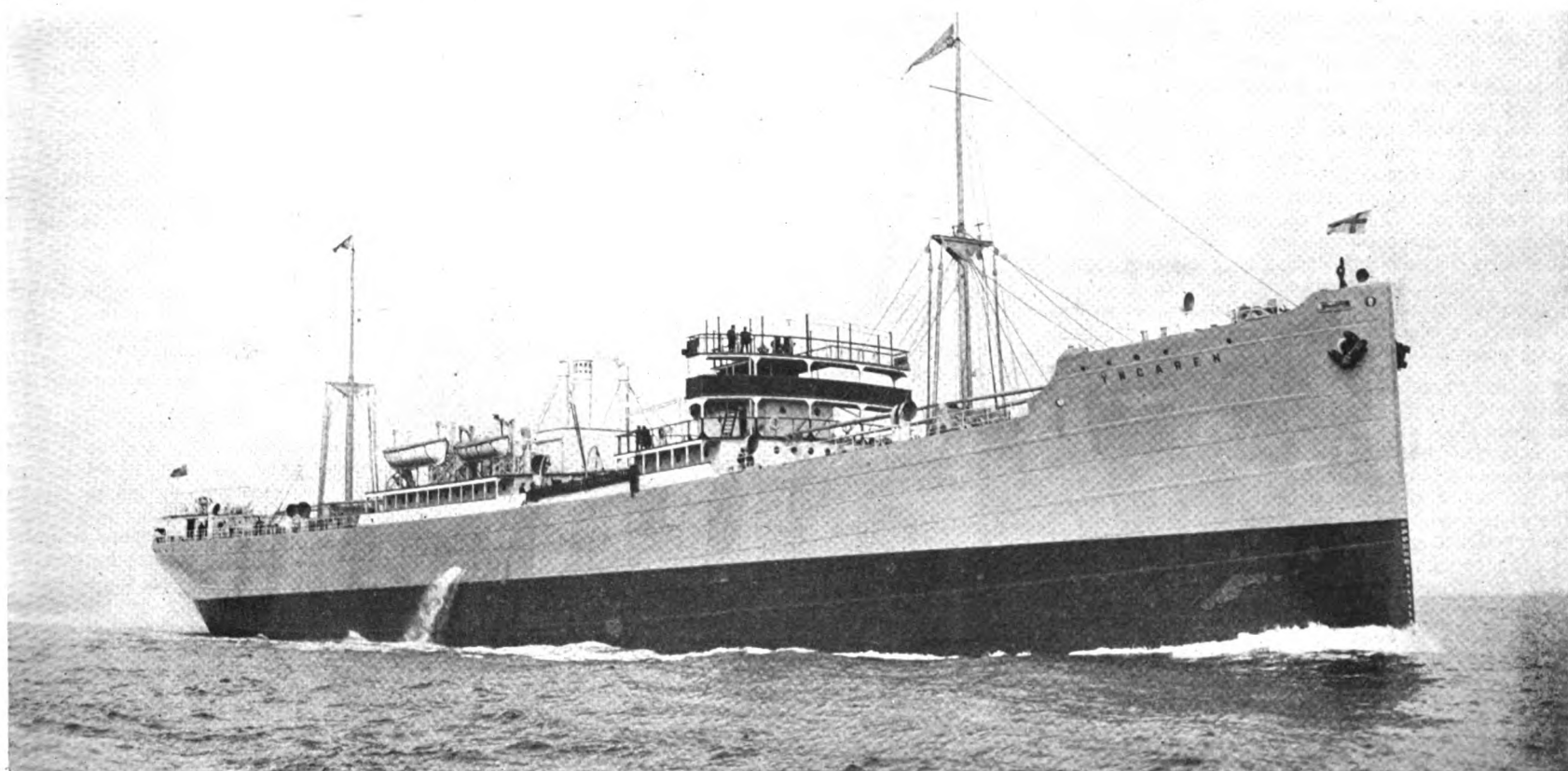
General "Hell and Maria" is Director of the Budget today, and he will want to know what you are doing to stop the waste of money, Mr. Lasker. Take a leaf out of his book: make a sacrifice to-day in order to save the money to-morrow.

Let our shipowners build motorships. The orders will save our shipyards. The motorships will save our merchant marine. The saving in oil will conserve our oil resources.

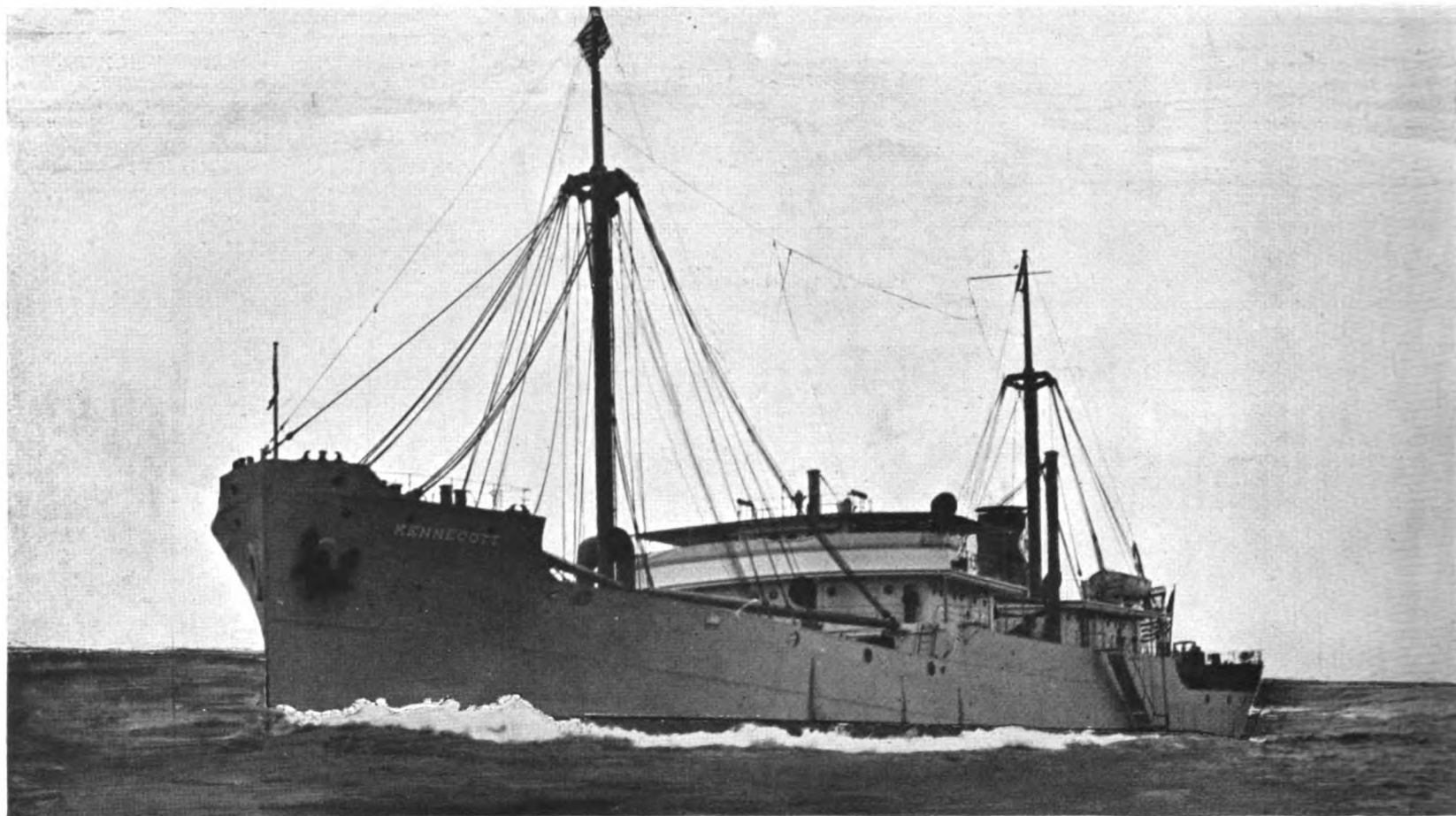
As an advertising adviser, you would not counsel a client to sell an out-of-date service, because you know the public would not buy and your client's business would fail. If you apply the same standard to the Shipping Board, you will see to it that the Shipping Board does not sell "steamer service," which will be undersold by "motorship service."

Nero fiddling while Rome burned had nothing on our previous Shipping Boards. Europe is operating motorships and building many more of them to take our tradewhilst the Shipping Board before your guidance has been occupied in endeavoring to excuse itself. Excuses don't help us to keep our shipping business. Motorships are what we need.

Keep the best of our steamers, but only the best ones—and convert many of these to economical motor power. Sink the rest of them! American shipbuilding to-day is in critical position. American shipbuilding must be saved! American shipyards must be protected! They cannot be left to rust out of existence. Build some modern ships and save the ship building industry.



The 12,750 tons single-screw Diesel motorship "Yngaren," built for the Transatlantic Line of Stockholm, by Doxford & Sons, Sunderland, England. She was fully described and illustrated in our issue of July, 1921



Pacific Coast built motorship "Kennecott" owned by the Alaska Steamship Company and propelled by twin 1,200 i.h.p. McIntosh & Seymour Diesel-engines. She averages about 265 nautical-miles per day on $8\frac{1}{2}$ tons of 16.7 Baume fuel-oil.

Pacific Coast Marine Interests Turn to Motorships

WHILE American shipping interests generally have been slow in awakening to a realization of the significance of the development of the internal-combustion motor for general marine transportation and have fallen far behind many of the foreign maritime countries in this respect, there is one section of the country, at least, where transportation men have seen the handwriting on the wall and are making ready to discard their out-of-date steam carriers in favor of the modern, economical and practical motor vessel. The record made by the new steel motorship "Kennecott," built this spring by the Alaska Steamship Company of Seattle, and the consistent performance of the Standard Oil Company's Diesel tanker "Charlie Watson" has opened the eyes of Pacific Coast shipping-men to the fact that the Diesel-type of engine has at last become an inevitable factor in transportation on the high seas and that the modern motorship offers the most economical and at the same time reliable means of transportation that the world has ever known. As a consequence a number of important transportation companies have announced their intention of not only confining all of their future shipbuilding activities to motorship types, but also as rapidly as possible of converting the steam vessels which they now own to Diesel power.

Programs of Important Shipowners

Most significant among the announcements which have been made along this line is that of the Puget Sound Navigation Co., which controls most of the freight and passenger traffic of the Puget Sound district, that this company will proceed with the construction of a new motorship for their Port Orchard Route, and are planning as fast as business conditions will permit to convert others of their fleet of twenty steamers to oil-engine power. This is a very important and significant proposal.

Another big company, the Puget Sound Towboat Co., which owns and operates some of the largest offshore steam-tugs on the North Pacific Coast, has had plans drawn for a new motor tugboat which will be powered with twin Diesel-engines of 1,200 b.h.p. each. Orders are also to be placed shortly by the Hibbard-Swenson Co. for a new motorship to engage in trade between Seattle and Siberia, while a number of smaller tugboat companies operating in coastwise and harbor work

Immediate Future to Bring Important Developments In Every Line of Shipping and General Marine Activity.—Pacific Coast on Verge of Motorship Boom

announce that their entire fleets will be converted to Diesel or surface-ignition oil-engine power as rapidly as the cost of conversion can be financed. In fact, a general survey of the marine field on the coast shows that it is on the verge of a motorship boom and that many significant developments may be looked for within the next twelve months.

Success of the "Kennecott"

The Alaska Steamship Company's new Todd-built "Kennecott" is not the only motorship by any means that has been built on the Pacific Coast, for there have been many motor-vessels constructed there in the past few years and most of them have been successful. But the fact that she was a steel vessel of unusual size and also that she marked the inauguration of a new policy by one of the largest and most prominent shipping companies in the American merchant-marine, focused the attention of shipping men upon her record to an unusual degree and therefore made her successful showing all the more conspicuous. Big shipping men who held the old-time traditional prejudice against any departure from steam and who were still imbued with skepticism on account of the unfortunate record of some of the hurriedly built and poorly equipped motorships constructed during the stress of wartimes, have been forced by the perfect record of this boat and her obvious economy of operation to admit that the motorship has at last won for itself a permanent and vital place in navigation on the high seas.

The operation of the tanker "Charlie Watson" is also being watched with great interest because she is now being followed by a larger motor-tanker with the same make of Diesel-engine. She has been employed regularly in the run between Puget Sound and Seattle, carrying petroleum products to the latter port from the Standard Oil Company's refinery at Richmond. She arrives one day, loads and departs the next morning, her engines running with even regularity.

It seems appropriate that the Pacific Coast, always in the lead in the utilization of internal-

combustion engines for smaller types of vessels, should be the first to assume a progressive attitude in the adoption of Diesel-power for big ship propulsion and that big companies on the western seaboard like the Alaska Steamship Co., the Puget Sound Navigation Co., the Puget Sound Towboat Co. and others, should be in the van among all the shipping concerns in the country in adopting and putting into effect a definite motorship program.

Probable Conversion of Kennecott's Sister Ship

While the Alaska Steamship Co. has not made any statement as to its program for the immediate future, yet the daily papers recently announced that it was contemplating converting the "Alameda," another of its steamers, to Diesel power, and it was thoroughly understood at the time the "Kennecott" was built that if it worked out successfully, the future policy of the company would be strongly in favor of vessels of this sort. E. T. Stannard, the vice-president and general manager of the company, has very modern ideas along these lines, having been entirely convinced of the practicability of the Diesel engine in his experience with some large installations of stationary engines in the Kennecott mines in Alaska, and his progressive policies are having a far-reaching influence at the present time among Pacific Coast shipping men generally. We understand that he was converted to motor-power for ships by reading *MOTORSHIP*.

The decision of the Puget Sound Navigation Co. to build a Diesel-powered ship for one of their most important runs out of Seattle is also a very significant step, as it undoubtedly marks the beginning of a revolution of passenger and freight transportation on inland waters. This company has for many years been the largest concern engaged in the steamship business on Puget Sound. It practically controls the local water transportation routes and operates most of the boats making the intercity and inter-island runs, including the routes between Seattle and Tacoma, Seattle and Everett, Seattle and Bellingham, Seattle and the Puget Sound Navy Yard, and many other runs of importance. It owns a fleet of twenty ships, all but one of which are steamers, the exception being the "Aloha," a small freighter powered with a Fairbanks-Morse "C-O" engine.

During the past two or three years, with the cost of transportation soaring and labor and fuel costs

far beyond all previous levels, many of the company's runs on which patronage has not been heavy, have not proven profitable for the expensive type of steamers which the company has been operating. It has long been obvious that the only solution for these minor runs, and for all of the different routes, in fact, was greater economy of operation and that the only way this could be obtained was by the use of cheaper power, such as is offered by the use of Diesel or surface-ignition engines.

18-Knot Diesel-electric Motorship

The recent decision of the Puget Sound Navigation Co. to build the new boat for the Bremerton-Navy Yard Route is undoubtedly the first step in this direction and marks the adoption of a definite policy, which undoubtedly will encompass the ultimate equipment of their entire steam-driven fleet with Diesel-type motors. The new boat will be a ferry, designed to carry passengers and automobiles. According to present plans she will be a vessel 213 feet long, with a beam of 45 feet, and will be powered with twin 750 shaft h.p. Diesel motors. She will handle 2,000 passengers and 60 automobiles. The engines will operate through electric-drive as designed by the General Electric Company, and the ship will have a speed of about 18 knots, which will permit her to make the trip from Seattle to Bremerton in an hour. Bremerton is the site of the Puget Sound Navy Yard, now one of the greatest naval stations in the country, and not only is the passenger patronage heavy between the smaller city and Seattle, but it is also the natural route for automobiles making the trip over the Olympic highway, so that this traffic also had to be taken into consideration. Undoubtedly if the new motor ferry works out advantageously, the company will adopt the ferry boat type for many of its shorter inland runs in place of their present type of steamers with their small carrying capacity.

2400 Horse-Power Diesel Tug

The Puget Sound Tug Boat Co.—distinct from the Navigation Co.—formerly owned a number of large ocean-going steam-tugs which they operated out of Puget Sound and off the Columbia River. This company is associated with the Puget Mill Co., one of the largest lumber and logging concerns on the Coast, and the tugs were used in connection with their own work and also in handling shipping in and out of the two harbors. They recently sold the "Tyee," "Holyoke," "Wanderer" and "Prosper," but still retain the tug "Pioneer." Whether their disposal of the steam-tugs was in preparation for carrying out a policy of replacing them with more modern heavy-oil vessels is not definitely known,

but it is significant that they have had plans drawn and will proceed shortly with the construction of at least one new Diesel-equipped deep-sea tug. The plans as prepared by L. E. Geary, naval architect of Seattle, call for a boat 245 feet in length with a tonnage of 2,600 and twin 1,200 h.p. Diesel motors. She will be used for towing heavy barges overseas and in coastwise work and will be, according to our information, the most heavily-powered Diesel tugboat so far built, anywhere in the world.

New Motorship for Alaska Service

Another important motorship to be built is the one that will be constructed by the Hibbard-Swenson Co. of Seattle to replace the motorship "Kamchatka," which was lost at sea through fire this spring while on her way to Siberia. The "Kamchatka" was formerly a steam bark, known as the "Thresher," and was purchased by the Hibbard-Swenson Co. last year and converted into a motorship, a 300 h.p. McIntosh & Seymour Diesel engine being installed. She was a vessel 144 feet in length, with a beam of 31½ feet. The new vessel to take her place will be considerably larger than this, although the details have not been made public. The trade between Siberia and Puget Sound has attained such vast proportions, however, and promises so much greater expansion in the future, that it is understood the company contemplates going into the business on a big scale, and that the new vessels will be built of sufficient size to be a big cargo carrier. It is also believed that she will be the forerunner of a number of big motorships built for this trade.

Diesel-electric Ferry for San Francisco

Another interesting development in a very important transportation field is the announcement by the Golden Gate Ferry Co. of their plans to build several Diesel-powered ferry boats for use on San Francisco Bay. The plans of these vessels which are shown elsewhere in this issue, provide for twin Diesel-engines operating with electric-drive, and the introduction of boats of this type into the ferry business on the Bay will undoubtedly affect the policy of the older companies now operating there, as the competition of the more economically operated boats would soon be felt. Question of general financial conditions, however, has delayed an actual order being placed as yet. The Southern Pacific Railway Co. at present operate a fleet of 13 big steam ferries and the Key Route a fleet of four which would provide some big installations for Diesel-engine manufacturers if it were found advisable to convert them to oil power. The Oakland & Antioch Railway Co. for a number of years have been operating one motor ferry, the "Bridgit," which is

equipped with a 500 h. p. Union distillate-oil engine, and it is understood that she has been very satisfactory and successful.

Another big market for heavy-oil engines that is developing is to be found among the numerous companies engaged in harbor and bay towboat work along the coast. In San Francisco, Oakland, San Pedro, San Diego, Seattle, Tacoma, Portland, Vancouver and in fact in all Pacific Coast ports are numerous companies owing some very large fleets of gasoline and steam tugs engaged in this work, and one by one these companies are deciding to convert their fleet to heavy-oil engine power.

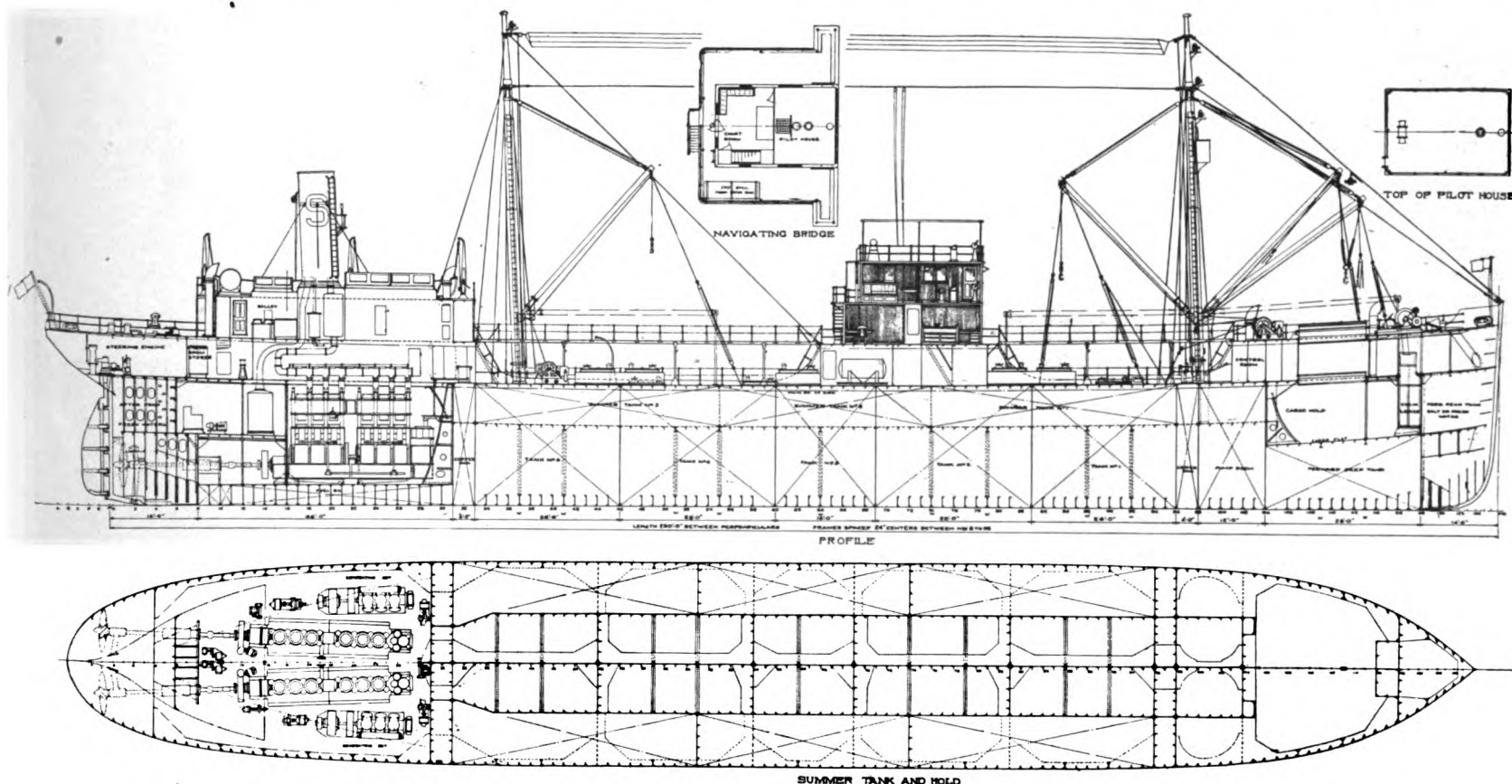
Many of the companies already have installed Diesel and surface-ignition engines and it will be only a question of time until their entire fleets will be so converted. This is especially true of the companies whose fleets are made up largely of steam-tugs where the cost of operation is more of a vital feature than with those operating boats powered with distillate-burning engines.

Steam Tugs to be Converted to Diesel Power

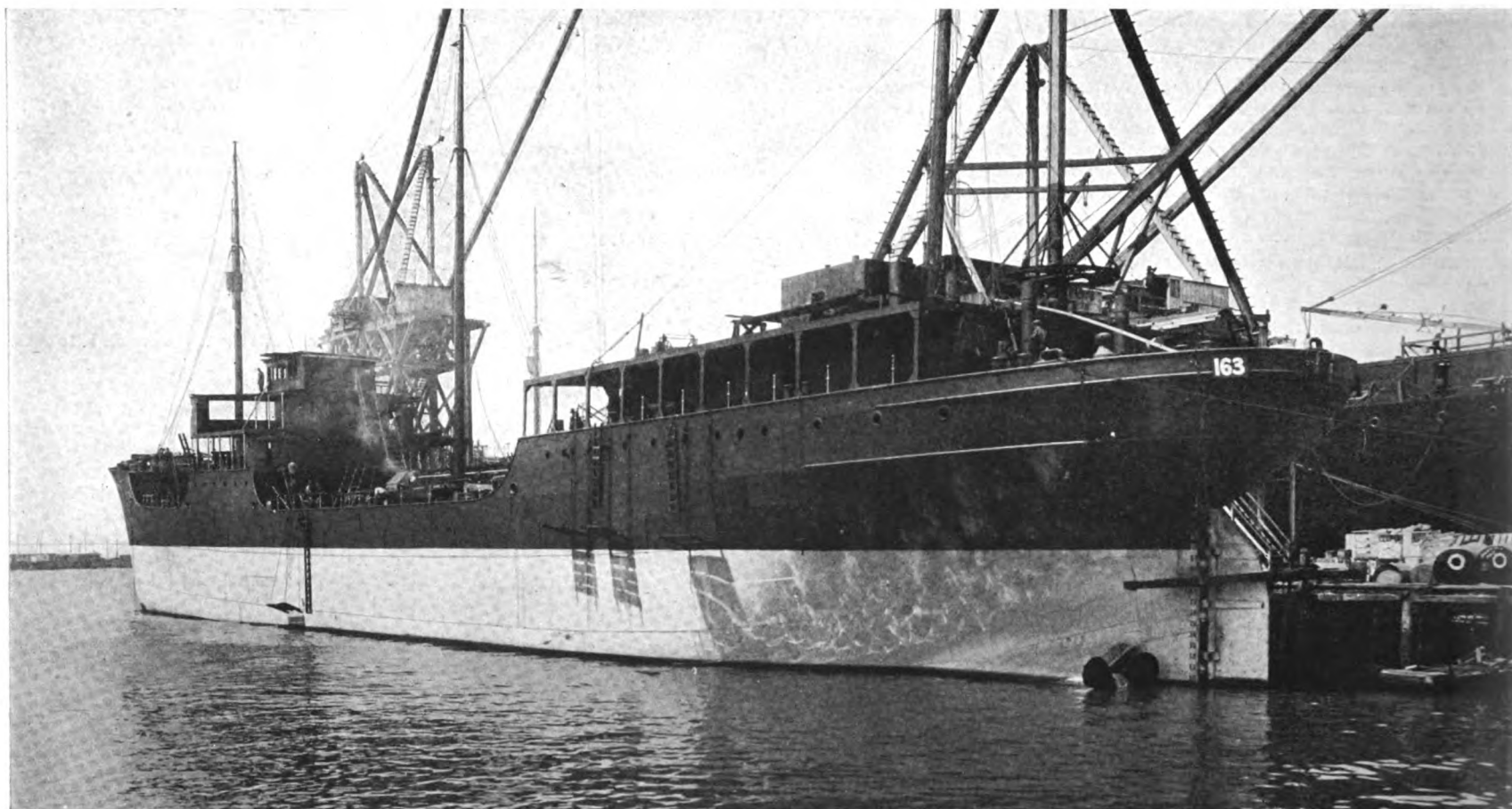
As an instance of one company of this sort may be cited the case of the Carey-Davis Towboat Co. of Seattle. This company owns a fleet of nine steam-tug boats and recently acquired the "Deep Sea," a heavy-oil engine tug which was originally built as a cannery tender for the Southern Alaska Canning Co. of Seattle. The company of the latter boat as well as the success of other oil-engined tugs operating out of Seattle has decided them to convert all their steam-tugs to Diesel power. The first tug to be converted will be the "Equator" which is now equipped with a steam-engine. She will be equipped with a 300 h. p. Diesel-motor of a type not yet determined. As fast as business conditions will permit, the "Katahdin," the "Holyoke" and the other boats will also be changed over until the entire fleet is Diesel-equipped.

The Pacific Towboat Co. of Seattle is another concern where similar changes in the fleet are being contemplated. This concern has reason to know of the economy and advantage of the heavy-oil tug as they built the first Diesel-equipped tug on the Pacific, the "Chickamauga." This boat was built in 1915 and is a 70-footer powered with a 240 h. p. Niseco Diesel-engine. She has been the most successful and most economical tug boat on Puget Sound and has given good satisfaction during six steady years of hard service.

The Lillico Launch & Towboat Co., which is the largest waterfront towboat concern operating out of Seattle, is also going in for heavy-oil power, having recently announced that their tugboat "Lillico No. 20," now equipped with a gas-engine



Plans of the Standard Oil Company of California's Werkspoor Diesel-driven tanker "Charlie Watson," built by the Union Construction Co., Oakland, Cal.



Standard Oil Company's new motor-tanker "H. T. Harper" fitting-out at the Moore Shipbuilding Company's yard. She is equipped with two 1140 i.h.p. Werkspoor Diesel-engines built under license by the Pacific Diesel Engine Company, Oakland, Cal.

is soon to be equipped with a 150 h. p. Diesel. This company owns eight towboats, 29 lighters and one car-ferry, and has always used motor-tugs, the present fleet being powered with distillate motors. The equipment of the "No. 20" is undoubtedly the beginning of the conversion of their entire fleet to engines burning heavy-oil.

Owens Four Heavy-oil Engined Tugs

The Independent Towing Co. of Seattle which is one of the largest towing companies on the North Pacific Coast, owns a fleet of fourteen tugs and has already equipped four of these tugs with heavy-oil engines. Two of these, the "Wasp" and the "Hornet," were built last year and of the other two, the "Bee" was formerly a steam-tug known as the "Nellie Pearson" and the "Cricket" was formerly powered with a distillate motor. These boats are all equipped with Fairbanks-Morse surface-ignition engines. The company are figuring on changing some of their old steamers into heavy-oil boats and all of the new boats they build will be powered with engines of this type.

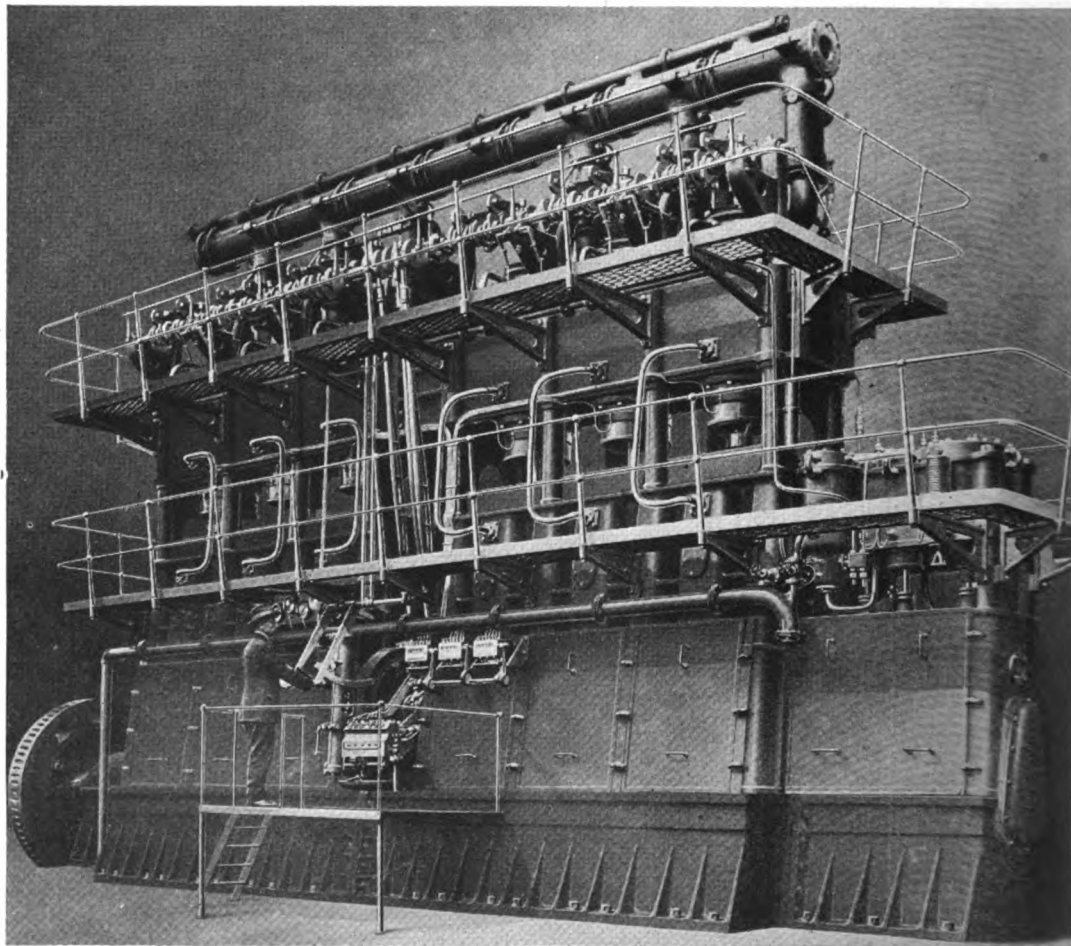
Another concern that has seen the advantage of the heavy-oil motor tug is the Foss Towboat Co. of Tacoma, which has the largest fleet of gas tugboats on the Sound. The Foss company at present own a total of 23 boats, two of which are steamers and the others motor vessels. Most of the boats are equipped with distillate motors and have been very successful but the high cost of distillate has influenced the company in deciding that all boats added to their fleet from now on will be powered with heavy-oil burning motors. The company already has three tugs of this sort, the "Foss No. 16," a 68 footer powered with a 200 h.p. Fairbanks-Morse "C-O," the "Lillian D. Foss," a 50-footer with a 45 h. p. "C-O" and the "Rouse," a 55-footer powered with a 100 h. p. Avance surface ignition engine made in Augustendal, Sweden. The latter boat belongs to the Rouse Towboat Co. of Seattle which is controlled by the Foss Company.

The Great Fishing Industry

In the Pacific Coast fishing industry, which has probably provided a greater market for internal-combustion engine than any other field in the world, we find the tendency toward motors of the heavy-oil type even more marked than among the towboat companies. In this field, there are eight types of boats which predominate, the cannery tenders or towboats used for fish carriers and general work around the salmon canneries,

the salmon purse-seine boats, the tuna purse-seine boats, the Japanese tuna boats which fish with hook and line, the salmon trollers and gillnetters the big halibut schooners and the long-line herring boats. In addition, there are numerous miscellaneous types such as oyster-boats, crab-boats, shrimp fishing-boats, etc. In the smaller sizes of boats such as the trollers and gillnetters, the distillate-engine still has the field and will probably continue to hold it, at least until the Diesel and

surface-ignition engines are perfected for smaller power, as these boats use engines ranging from 4 to 36 h. p. In the larger types, however, such as the halibut-schooners, cannery-tenders and purse-seiners, the heavy-oil engine is rapidly gaining a hold. Practically all of the cannery tenders built during the past two years have been powered with oil engines, the surface-ignition types such as the Fairbanks-Morse and the Kahlenberg predominating. This year a number of Diesel-engines



One of the twin 1,150 i.h.p. Werkspoor Diesel-engines in the Standard Oil Co. of California's new motor-tanker "H. T. Harper" now completing at Moore Shipyard. The engines were built under license by the Pacific Diesel Engine Company of Oakland, Cal.

have been put on the market in smaller power and several installations of motors such as are made by the Enterprise Engine Co. of San Francisco, the Atlas Imperial Gas Engine Co. of Oakland and the Western Machinery Co. of Los Angeles, have been made, these motors going into cannery tenders and towboats built for charter. Nlsec Diesel-engines have also been operating for a number of years in cannery tenders such as the "Warrior" and the "Chomley." The seineboats, which use motors of smaller size, ranging from 48 to 65 h. p., and usually do not have trained engineers, have been slower in adopting the heavy-oil motors, but during the last two years, quite a number of these boats have been powered with Fairbanks-Morse and Kahlenberg oil-engines and undoubtedly from now on the greater portion of these boats will be so equipped.

The same is true of the Japanese tuna boats. Very few oil engines have been installed in the halibut schooners, but this is probably because none of these boats have been built during the past three years owing to the growing scarcity of fish and the greater success of the smaller boats known as "long-liners."

The Pacific Diesel Engine Co. of Oakland, formerly known as the Skandia Pacific Oil Engine Co. have installed a number of Werkspoor-Diesel and Skandia surface-ignition oil engines in boats built on the Coast, mostly in auxiliary cargo-schooners and in full-powered tankers.

The market on the Pacific Coast for Diesel and surface-ignition oil-engines is almost unlimited for vessels both large and small. In addition to the



Type of ferry used in Frisco Bay, now steam-driven but likely to be converted to Diesel-electric power.

MARINE CONSUMPTION OF FUEL-OIL

Practically complete returns to the American Petroleum Institute from companies engaged in the marine fuel-oil business and from the United States Navy show that in 1920 a total of 44,487,319 barrels of fuel-oil were delivered for ships' bunkers, as compared with 27,102,616 barrels in 1919, an increase of 64.1%. The figures compare as follows:

	Deliveries of Fuel-Oil		Per Cent (Incr. or Decr.)
	1920 (Barrels)	1919 (Barrels)	
To Merchant Vessels	38,436,300	18,188,974	Inc. 111.3

208,976 barrels of this was Mexican oil. In 1919 the total was 7,240,358 barrels. The following table gives fuel-oil deliveries made for ships' bunkers in 1920 by companies reporting to the American Petroleum Institute.

Fuel Oil Delivered for Ships Bunkers, 1920 and 1919

	At Atlantic Coast Ports		Total (Barrels)
	Domestic Oil (Barrels)	Mexican Oil (Barrels)	
1920	208,976	19,117,434	19,326,410
1920	*12,264,245		12,264,245



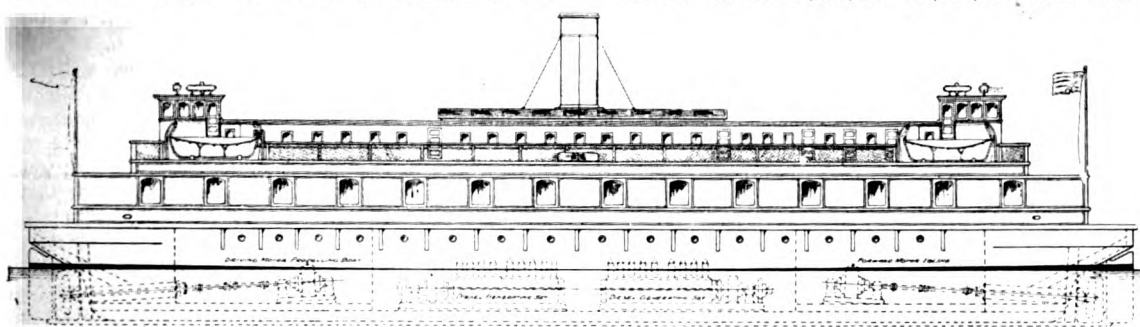
"Equator," one of the steam tugs of the Carey-Davis Tow Boat Co., Seattle, which will be changed to Diesel power. A 300 h.p. engine will be installed

	At Gulf Coast Ports		
	Domestic Oil (Barrels)	Mexican Oil (Barrels)	
1920	2,164,539	1,922,981	4,087,520
1920	1,807,928	950,197	2,758,125

*Includes small quantity of Mexican oil blended with domestic.

OIL-ENGINE IN CANNERY TENDER

In a 65-ft. cannery-tender recently launched at Sunde & Olsen's yard, Lake Washington Canal, Seattle, Wash., for Capt. Ca. W. Isaacson of Seattle, a 75 h.p. Kahlenburg surface-ignition oil-engine is being installed.



Proposed Diesel-electric ferry-vessel for San Francisco. (See page 647 for details)

types mentioned, there are many miscellaneous boats, such as passenger-boats, powder-boats, oil-boats, South-Sea and Arctic-Trading Schooners, and number other types. Large numbers of new boats of these types built every year and the thousands of boats already in commission will sooner or later have their old engines removed and new ones installed that will burn heavy-oil.

Not only has the day of the big motorship arrived, but the opportunity is at hand to develop a market which will include every type of oil engine ranging all the way from 15 to 3,000 h.p. and the manufacturers that get in now on the ground floor and get their products well-known and established will be the ones that reap the greater part of the harvest.

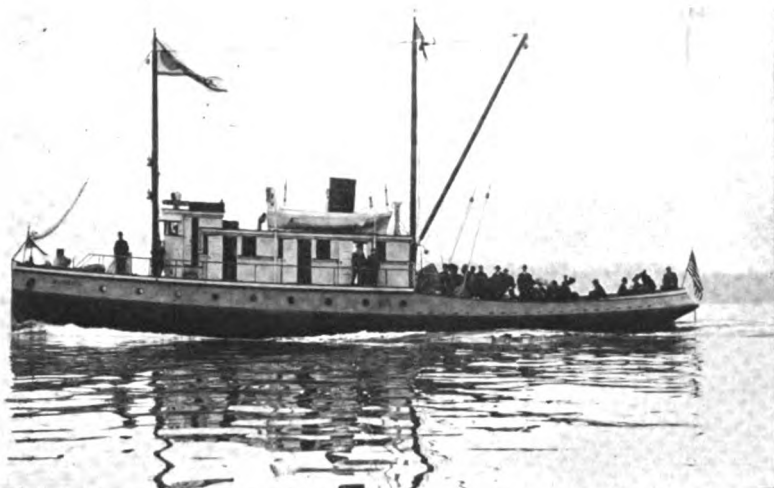
To U. S. Navy..	6,051,019	8,913,642	Dec. 32.1
	44,487,319	27,102,616	Inc. 64.1

For vessels engaged in coastwise and foreign trade, including those of the U. S. Shipping board, 21,990,612 barrels of Mexican fuel-oil and 16,446,688 barrels of domestic fuel-oil, a total of 38,436,300 barrels were delivered in 1920 at ports of the U. S. and Insular Possessions. This compares with 8,590,406 barrels of Mexican oil and 9,598,568 barrels of domestic oil, a total of 18,188,974 barrels, in 1919. The oil used by the Navy is a blend of domestic and Mexican oils and the statistics as to the relative quantities are not available.

The bulk of the fuel-oil delivered to merchant vessels in 1920 was handled at Atlantic Coast ports, the total being 19,326,410 barrels all except



"Tacoma," one of the Puget Sound Navigation Co.'s steam-driven ferry on the run between Seattle and Tacoma. We have painted-out the smoke stack to show how their new 18-knot Diesel-electric ferry vessel will look. This company operates 20 steamers and as soon as practicable will convert them to Diesel or Diesel-electric power



"Warrior," the first Diesel-driven commercial motor-vessel in America



"Chickamauga," the first Diesel-driven tow-boat in America

History of Heavy-Oil Engine Development on the Pacific

By DANIEL L. PRATT

Editor of "Motorship's" sister publication,
"Pacific Motor Boat"

THE Pacific Coast has always led in the utilization of the marine internal-combustion motor for commercial purposes. The first marine gasoline engine successfully marketed was manufactured on the Pacific Coast, and the small commercial craft of the western seaboard were quick to take the lead in the development that followed. Peculiar industrial requirements, such as those of the lumber and fishing industry, lack of railroads of any kind, long stretches of inside waterways, protected from bad weather and open to navigation at all seasons—all of these things contributed to make the development of great fleets of commercial motor boats and motor vessels a natural and logical outcome.

For many years before any talk of Diesel or surface-ignition engines penetrated from Europe to the western waterways, the people of the Pacific Coast knew marine internal-combustion engines, understood how to use them and were exceedingly progressive in adopting any improvements that tended toward increased reliability, durability or economy. The matter of economy, perhaps, had not concerned them so greatly as in other parts of the country, owing to the fact that for fuel purposes they had the benefit of distillate, a by-product peculiar to California oil that was sold as cheap or even cheaper than kerosene and on which all of the motors on this coast and a number of those made in the East, would operate.

Nevertheless, when rumors began to reach the West coast about a remarkable type of motor which had been developed in Europe, that would operate on crude-oil, at a cost then of about two cents a gallon, they were interested; more interested, probably, than any other part of the country because of the great number of motor work-boats in service on this coast and their value to industry and commerce. The Westerners read eagerly all the news about the perfection of this motor, of its record of operation and especially of its success in large units as against steam. They even sent to Europe for catalogues and literature. The one great question that was most discussed was as to whether or not the Diesel-motor would operate on the asphaltum base oil used on the Pacific Coast. Tests that were made of this oil in Europe and on stationary engines in the East, revealed some difficulty of operation as compared to the paraffine-base oils. But in those days there were no Diesel engines manufactured by American concerns and none of the European makes were available for installation on this coast, so that the subject was all one of theory and conjecture.

It was not until an American concern finally commenced the manufacture of a Diesel engine that the heavy-oil motor first began to seem close enough to the Pacific Coast to become a considered factor. The first news of this new engine reached the people of the Pacific Coast in June, 1912, through a four-page advertisement in our sister journal, "Pacific Motor Boat," inserted by the New London Ship & Engine Co., of Groton,

Conn., announcing the fact that they had taken over the United States rights of the Nurnburg (German) type for America, and would start manufacturing these engines immediately. The announcement created immediate interest, and the Seattle office that was opened by this company was flooded with inquiry concerning the new motor, although there was still a great deal of skepticism as to whether or not any Diesel-engine would work on California fuel.

The first engine of the Nelseco type was not installed in a commercial vessel on the coast until the fall of 1913, the factory having been busy with engines for submarines for the United States

heavy-oil engines, and advertising these engines for installation. Several of these engines were installed in British Columbia but were not very satisfactory, with the exception of an installation of an Avance engine made in a Prince Rupert boat, which is working satisfactorily to this day, the engine having afterward been installed in a tug for the Rouse Towboat Co. of Bullard.

In the meantime one of the schooners built at Boston with the surface-ignition engines in it sailed for the coast, arriving there in the summer of 1913. Its record was watched with interest by many motor boat owners on the Pacific, as it was the first actual example of a heavy oil boat that had ever appeared on the coast. Unfortunately, however, the manufacturers were a little premature in marketing their motor, not enough tests having been made, and the engines in the schooner reaching the coast did not give a good account of themselves, especially on Pacific Coast fuel, with the consequence that the vessel was afterwards equipped with heavy-duty gas engines, consequently they have not built oil-engines since. This first example of heavy-oil engine operation in west coast waters was unfortunate, as it undoubtedly established an unfounded prejudice against such motors for a time that was hard to overcome.

As stated before, the first Diesel-engine installed on the coast was the 120 h.p. "Nelseco" that was installed in the cannery tender "Warrior" for the Pacific American Fisheries of Bellingham. The "Warrior" was built at Seattle during the Fall of 1913, and was launched and put in commission in the early Spring of 1914. Without practically any preliminary adjustments or difficulty, she started on her trial trip with her engine working perfectly on California asphaltum-base oil and her exhaust as clear as that of a well-controlled gas-engine. She left soon afterwards for Alaska, but even before she left she had demonstrated in several trips that a heavy-oil engine could and would

operate on California oil, and thus a lot of doubts were dispelled and the heavy oil-engine commenced to loom up as a real factor in Pacific work boat navigation.

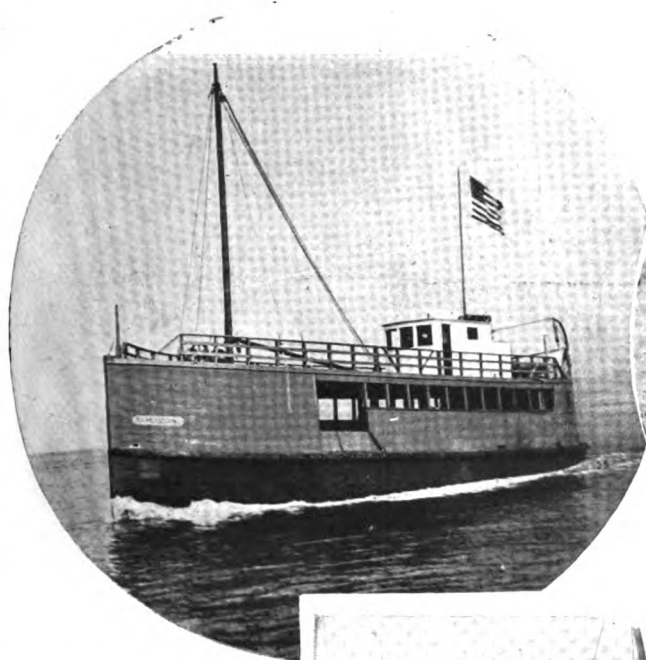
Before leaving the subject of the "Warrior" it is interesting to note her record for the first seven months of her Alaska season. She is an 87-foot cannery tender used for carrying fish and for towing heavy pile drivers, scows of fish, etc., in the rough waters of the North Pacific. In the seven months' season she ran 1,658 hours, covering a total of 11,606 miles. Her entire fuel cost for the season was \$214.07, her lubricating cost \$80.09, her repairs and upkeep \$148.58. In other words, her fuel cost per hour was 13 cents and her lubricating cost 4½ cents. She has continued to give good satisfaction throughout seven years of steady service since that time.

About the time the "Warrior" was launched and successfully tried out, another heavy-oil engine appeared on the Pacific Coast market. This engine was the Bolinder, made in Sweden, a surface-ignition engine much used in the old country. It

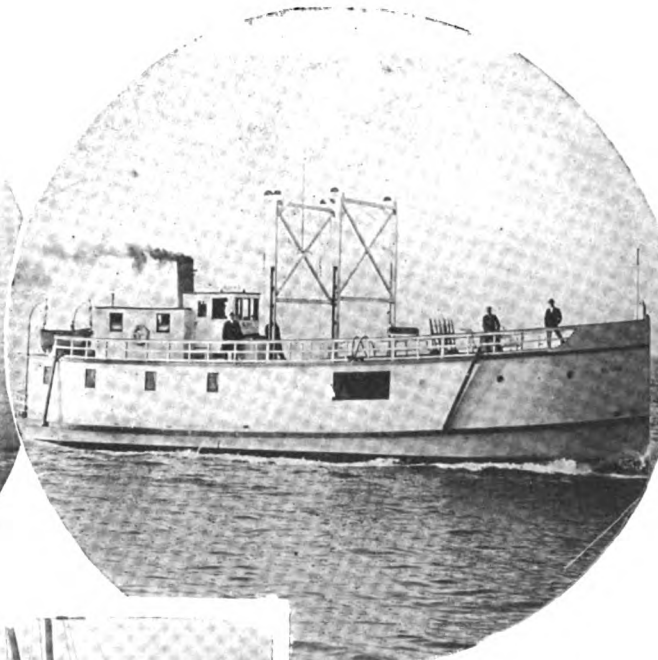


"Chomly," the record Pacific Coast Cannery tender to be Diesel-powered. Like the "Warrior," and "Chickamauga" she has Nelseco engines

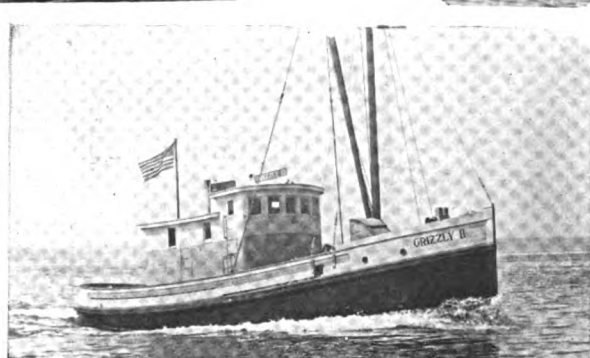
and other navies, several of which were installed in boats on this coast and worked with success on western oil. Earlier in the same year, however, before the first Diesel-engine was installed in the "Warrior," another heavy-oil engine manufacturer started advertising for coast business. This was a concern in Massachusetts which had started manufacturing a surface-ignition or hot-bulb type of engine. Their first advertisement appeared in *Pacific Motor Boat* in March, 1913, and stated that they had installed engines in two new halibut schooners, the "Bay State" and "Knickerbocker," which would soon leave Boston to sail around the Horn to this coast where they would be operated on the Pacific halibut banks. Almost at the same time, an announcement appeared among the advertising columns from the Heaps Engineering Co., a Vancouver concern, stating that they had taken over the rights to manufacture on this coast the Junkers opposed piston Diesel engine, but this was followed the next month by a statement that the company had taken the agency for certain European surface-ignition or



The freighter "Amazon"
Driven by a Fairbanks-
Morse oil-engine



The freighter "Aloha"
powered with a Fair-
banks-Morse oil-engine



"Grizzly II"—A Diesel-powered cannery tender
built at Seattle for Capt. Frank Nordland. She is
powered with a 100-h.p. Enterprise Diesel engine

was introduced to the Pacific Coast market by Henry Lund & Co., of San Francisco, their first advertisement appearing in *Pacific Motor Boat* of February, 1914. Later in the season an engine of this type was installed in the "Gracie S.," a San Francisco Bar Pilot schooner, and it worked very successfully, as did also an installation made soon afterward in the tugboat "Mary L. Hanlon" of San Francisco. Dozens of Bolinder engines have since been installed on the Coast.

In 1914 Nelseco Diesel-engines were also installed in the new passenger boat "Suquamish," owned by the Kitsap County Transportation Co., a 92-foot vessel operating on regular passenger runs out of Seattle. This boat is now running 132 miles a day, or 24,300 miles a season, at a fuel cost per mile of 11/3 cents and a cost for 12 1/2 hours of running each day of \$1.76. The record of this boat is more fully covered elsewhere in this issue.

In 1914, the Fairbanks-Morse Co. also announced a surface-ignition engine, and an installation was made in the tug "Lorens" of the Porter Fish Co., of Anacortes, the first semi-Diesel engine installed on Puget Sound. This installation has since been followed by many others, all of which are now working very successfully.

In the spring of 1915, Nelseco Diesel-engines were installed in the cannery tender "Chomley," owned by the Alaska-Pacific Fisheries Co., and in the tug "Chickamauga," owned by the Pacific Towboat Co., of Seattle. Thus the Pacific Coast had the honor of having the first Diesel vessel of any kind (aside from demonstrating boats) in Amer-

ica, and also the first Diesel tugboat and the first Diesel passenger-boat. The West Coast also showed its progressiveness in being quick to seize upon the advantages of the surface-ignition oil-engine.

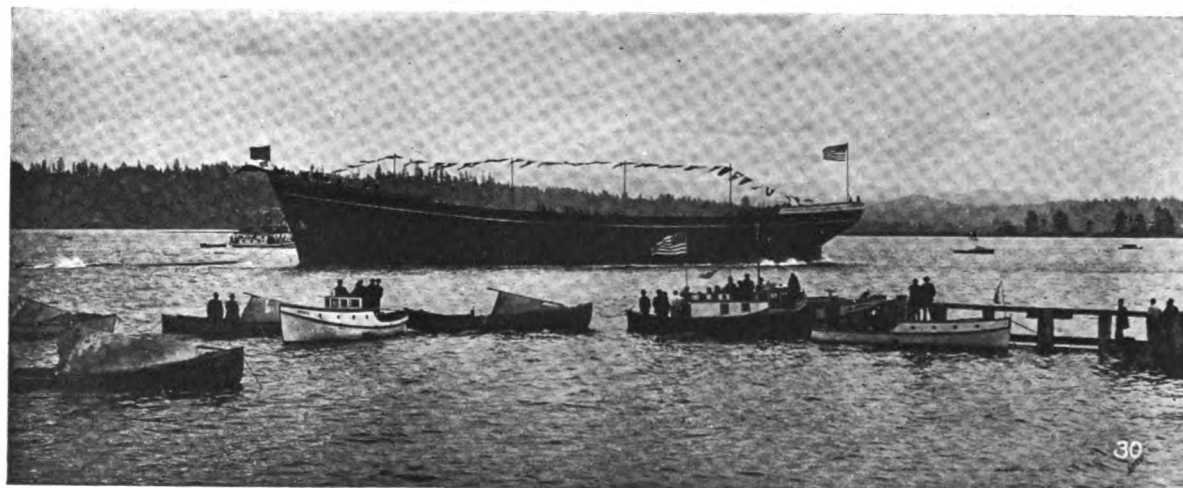
With the success of the heavy-oil-engined boats built in 1914 and 1915, and with the additional impetus given by the demand created by the war for vessels of all kinds, the beginning of 1916 saw the Pacific Coast in the midst of a veritable heavy-oil engine boom. There was a demand for Diesel and surface-ignition engines of all kinds, but especially for vessels of larger sizes. The sudden recovery of the lumber market brought on a demand for lumber carriers both for the coastwise and the foreign trade that could not be supplied. The advantages of the large sailing-schooner equipped with heavy oil-engines for auxiliary power became very apparent. Before the beginning of the year a keel was laid for a large vessel at St. Helens, Oregon, to be equipped with Bolinder heavy-oil engines for auxiliary power. Then another was started at Aberdeen, and soon there was scarcely a wooden shipbuilding yard on the coast that was not busy building motorships.

This was not all the result of a war-time boom. In fact, the first motorships that were built were American-owned boats for the lumber trade. Some of these were auxiliary vessels and some full-powered motorships. The first vessel to be launched, as previously mentioned, was the "City of Portland," built at St. Helens, Oregon, for the Charles R. McCormick Co. of San Francisco, and was the first of six boats ordered for this concern, some of which were afterward sold to other interests. She was the largest single-deck vessel ever built on the Coast, and was launched in the summer of 1916. She was an auxiliary schooner 278 ft. in length, with a beam of 48 ft. and a depth of 22 ft. She carries 1,200,000 ft. of lumber, and was powered with twin 320 b.h.p. Bolinder surface-ignition oil-engines.

On her first trip across the Pacific she made an excellent record, leaving the Columbia River on August 3, 1916, arriving at the San Francisco lightship at 5 P. M. August 6th, at Honolulu, August 19th, and at Port Pirie, Australia, Sept. 28th. No trouble was encountered, the motors running smoothly, and from Sydney to Port Pirie she developed steamer speed.



"Mutual"—A cannery tender for the Mutual Packing Co. of Anacortes, Wash., and powered with a 100-h.p. Fairbanks-Morse engine



Launch of the wooden motorship "City of Astoria" at Astoria, Oregon, for A. O. Anderson & Co.

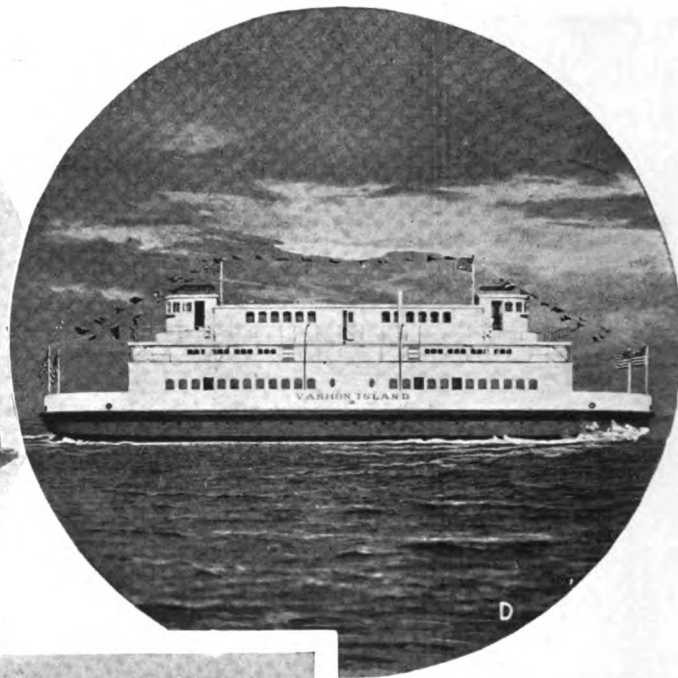
The success of this vessel and of others which followed led to the building of many other vessels of the same type. The shortage of tonnage due to the European war was beginning to make itself felt, and there was a demand for ships of every type. The Pacific Coast with its almost unlimited supply of big timbers naturally became the seat of the wooden shipbuilding industry, and practically all the wooden ships built with the exception of the ill-fated Ferris types, were motorships. The first full-powered motorship to be built was the "Sierra," which was built the same year for the E. K. Wood Lumber Co. at Aberdeen, Wash. She was at first designed for the Coastwise lumber trade, but upon completion was found superior to this trade and was altered somewhat to make her suitable for offshore business. She has a length over all of 218 ft., a beam of 42 ft. and a depth of hold of 15 ft. She was powered with twin four-cylinder Bolinder engines of 320 h.p. After several local trips on the Coast to give her a thorough try-out, she was sent on her first long voyage to Valparaiso with a load of lumber and made the 11,000-mile trip very successfully, averaging in her fuel consumption only 21.6 barrels of Star fuel-oil a day at a cost then of \$1.15 a barrel. Like the "City of Portland," she was the forerunner of a number of other vessels of her class.

In April, 1916, "Motorship" was started at Seattle by Miller Freeman, and in two years became of such international importance that the publication office was transferred to New York in June, 1918.

To go into details regarding the scores of wooden motorships of the straight and auxiliary type that were built in the next two or three years would require too much space here to be practicable. Every plant that could possibly be used for building ships was put into service, and scores of new plants were established from San Diego to Vancouver, B. C. For a while the yards were launching new motorships at the rate of several a day. In Portland and Seattle, especially, a ship-launching was a daily occurrence. Aside from the earlier boats built for the lumber trade, the bulk of these vessels were for Norwegian owners, although many were also built for the French, Australian and other foreign governments. Then the war ended suddenly and the wooden shipbuilding boom collapsed.



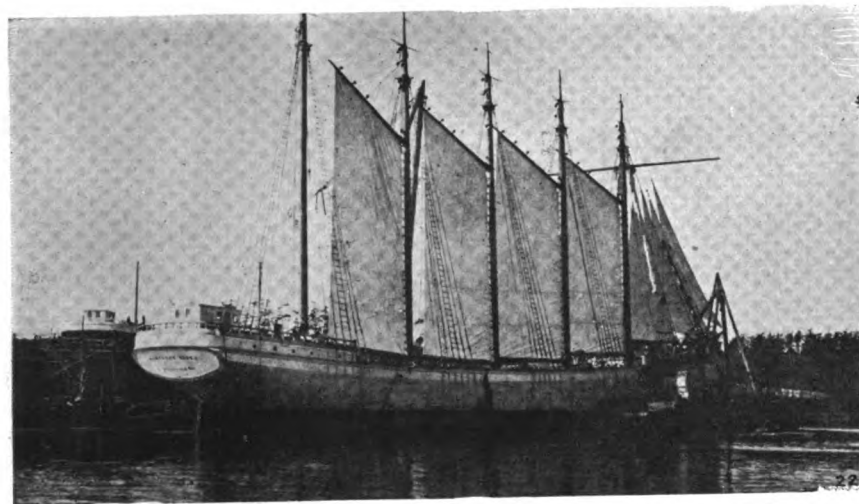
Diesel Ferry "Robert Bridges"



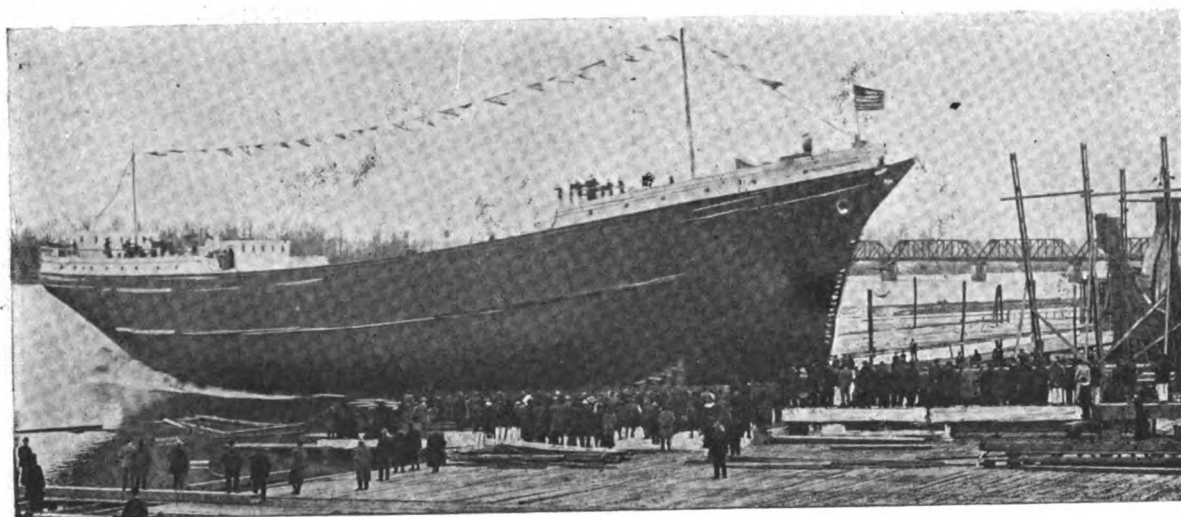
Atlas Diesel-driven Ferry "Vashon Island"



Heavy-oil engine passenger boat "Carlisle II"



"Margaret Hanley," one of the motorships built at the Cameron Yards at Victoria, B. C. They are five-masted vessels powered with twin 160-h.p. Bolinder auxiliary oil-engines. Owners, Canada West Coast Navigation Co.



Launch of the motorship "W. F. Burrows" at Portland for Libby, McNeil & Libby of Seattle, who use her as a salmon carrier between Puget Sound and Alaska. She is powered with twin 240-h.p. Skandia oil-engines

Most of the ships built for foreign accounts were powered with foreign-built engines that were shipped in. These, unfortunately, were poorly installed and poorly operated and many of the wooden hulls were poorly built. The consequence was that many of them—in fact most of them—have trouble and lots of it. Few facilities for spare-parts and repairs were available. This left a bad taste in the mouths of Pacific Coast shipping men, and made them skeptical for a while of oil-engines in general. It was a handicap that was hard for American oil-engines manufacturers to overcome, and in fact is only now beginning to be overcome, as the result of the success of Libby, McNeil, & Libby's freighter, "Libby Maine"; the Alaska Steamship Company's new motorship, "Kennebec," and the Standard Oil Co.'s motor tanker, "Charlie Watson," whose records have demonstrated to Coast shipping interests generally that internal-combustion motors in large power have been perfected that are just as reliable as steam, and that are so much more economical that they must be taken into consideration henceforth as the most vital factor in marine transportation. That is the reason why concerns like the Puget Sound Navigation Co., the Puget Sound Tow Boat Co. and many others are now planning the immediate construction of oil-engined vessels. The Diesel-engines of the "Charlie Watson" were built by the Pacific Diesel Engine Co., who in 1918 acquired a license to build the Werkspoor Diesel engine. Mention must be made of the very successful Winton-engined motorship "James Timpson," built on the Pacific Coast, but owned in New York.

This skepticism which the war-boom motorships caused in general shipping circles toward the oil-engine did not, however, affect the field of smaller motor vessels. The success of boats like the "Warrior," the "Chomley" and other fishing-vessels previously mentioned was so marked that the progress of the oil-engine in this field has been steady. This was augmented to a large extent by the shortage in fuel that existed for a time and the high price that still prevails that makes the operation of many of the high-powered gas-engined boats very expensive, if not almost prohibitive. Last year the shortage of fuel became so acute that distillate was practically withdrawn from the market, and this condition has resulted in operators of cannery tugs, fishing-vessels and general towboat men turning to the oil engine for relief.

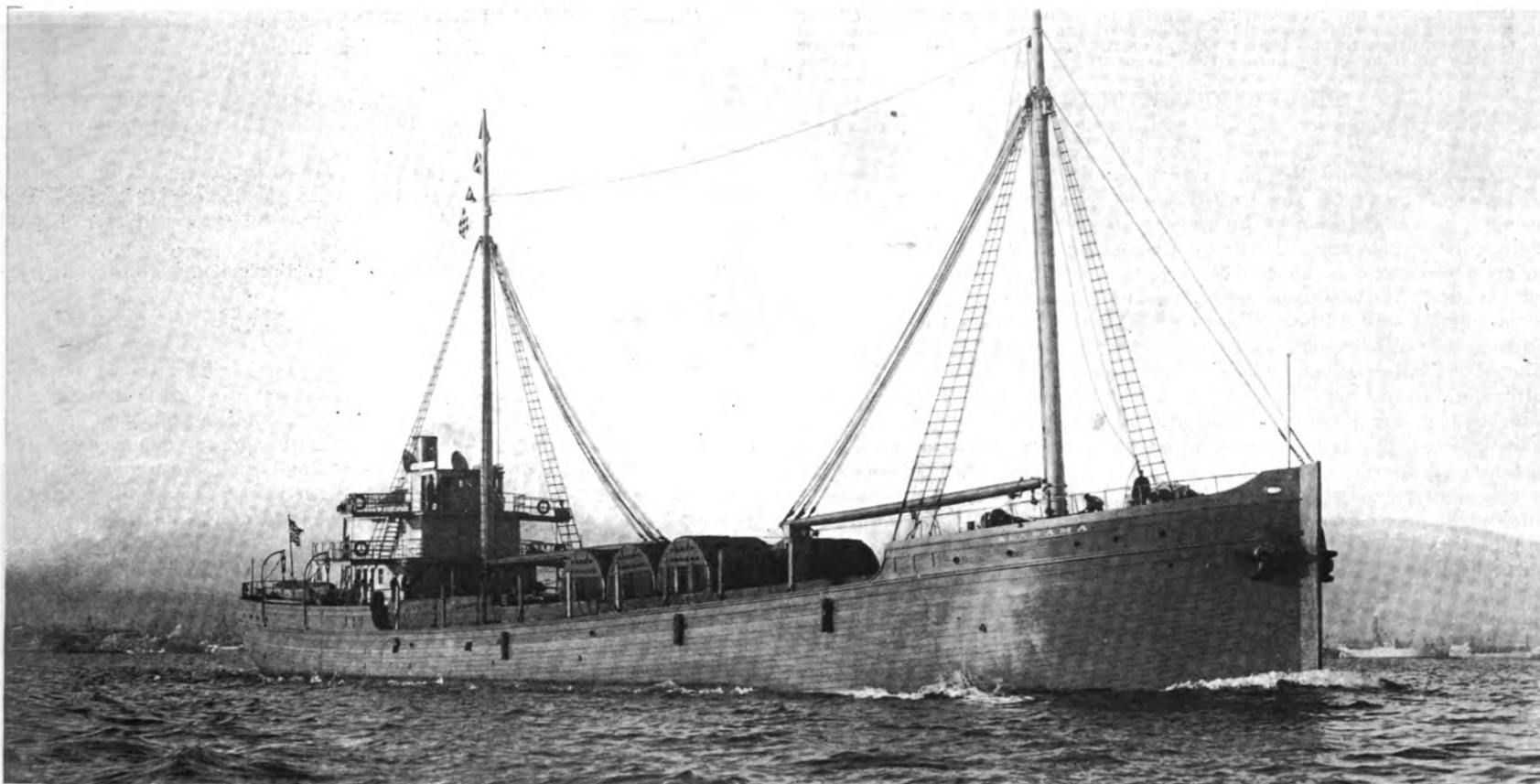
During the last two or three years there have been many new cannery tenders built that were equipped with motors burning heavy-fuel, most of these being of the surface-ignition types,

the Diesel-engine in small sizes not having, until recently, been available. To give some idea of how extensive this business has been, it might be stated that the Seattle branch of Fairbanks-Morse & Co. has, since this company's "C-O" type of surface-ignition oil-engine was put on the market, sold more motors than any of this company's other branches in the country, having installed, largely in the last two years, a total of more than 70 engines totalling over 6,000 h.p., the motors being mostly in 75 and 100 h.p. sizes. An excellent record has also been made by the Coast distributors of other surface-ignition motors.

Not all of these engines by any means have gone into fishing-vessels. Many of them have been installed in freighters and towboats and a few in passenger boats. On Puget Sound are a number of small freighters such as the "Aloha" and "Amazon," running on regular schedules in successful opposition to the steamers in carrying cargo. In the San Joaquin Delta country of California, freighters powered with oil-engines are becoming

very numerous, and are drawing the steamers out of business entirely. Nearly all the big waterfront towing companies at Seattle, San Francisco and other points now have one or more tugs powered with motors burning heavy-oil, and most of these companies plan to convert their old steamers over to this power as rapidly as possible.

And so it may be seen that the Diesel and surface-ignition engines have arrived on the Pacific Coast to stay, and that the motorship and smaller motor-vessel both have already become indispensable factors in commerce and transportation. Just as in the matter of small motor-vessels, the Pacific Coast has always led all other parts of the country; so also has it fallen to the lot of the Western seaboard to produce the "Kennebecott," the second largest all-American built steel motorship now on the high seas. And judging from present indications, it will be Pacific Coast shipping companies that will take the lead in producing the first real fleets of modern, up-to-date steel motorships sailing under the American flag.



"Isle de Java," ex "Alabama," a wooden motorship built in 1918 for the Alaska Pacific Navigation Company, but sold to French interests. She is propelled by twin 625 b.h.p. McIntosh & Seymour Diesel engines

MOTORSHIP BOUGHT FOR PACIFIC SALMON TRADE

P. E. Harris & Co., of Seattle, Washington salmon-packers and selling agents, recently purchased the 2,450-ton wooden motorship "General Pershing," and will use her for the transportation of canned salmon and supplies between the mainland and Alaska canneries. Mr. Harris announced the purchase on returning from a hurried trip to the Atlantic Coast, where the deal was closed. The vessel was bought at a U. S. marshal's sale at Norfolk, Va., on terms that are considered very advantageous to the company, and she will be brought to the Pacific as soon as possible.

The novel feature of the matter is the intention to load canned salmon at various points in Alaska, taking it direct through the Panama Canal and distributing it among various Gulf and Atlantic seaports, returning with tin plate and other cannery supplies for the following season. In this way it is expected that important economies in transportation and handling costs will be effected, the expenses connected with landing and loading cargo at Pacific terminals being entirely avoided.

The prospect of success is materially increased by the low operating cost of a vessel of this type. She is an auxiliary wooden vessel, rigged as a 5-masted bald-headed schooner, powered with two 350 h. p. Sumner surface-ignition engines. She

was built in 1918 by the Olympia Shipbuilding Company, Olympia, Wash., for Norwegian interests, and operated successfully for some time in the Atlantic trade. She is 266 ft. long, 48 ft. wide and 24 ft. deep, with a tonnage of 2,451 gross.

DIESEL-ELECTRIC FERRY FOR VANCOUVER

Plans have been prepared for a Diesel-electric propelled ferry-vessel for the City of Vancouver, B. C.

SKANDIA COMPANY CHANGES NAME

We have been officially advised that the Skandia Pacific Oil Engine Co. of Oakland, Cal., recently changed its name and hereafter will operate under the new name of PACIFIC DIESEL ENGINE COMPANY, devoting its entire plant to the manufacture of marine and stationary Diesel-engines. This firm owns the sole manufacturing rights on the Pacific Coast of the U. S. A. for the well-known Werkspoor-Diesel engine, and have constructed about a dozen engines of 650 to 1,150 i.h.p.

MOTORSHIP "CANADA" VISITS VANCOUVER

Recently the 9,400 tons motorship "Canada," sister to the "Buenos Aires" of the Johnson Line, visited Vancouver, B. C. She discharged 2,200 tons of sugar at the B. C. Sugar Refinery Wharf and then loaded salmon and general merchandise at the wharf of Evans, Coleman & Evans.

BETHLEHEM SHIPBUILDING COMPANY AND MOTORSHIPS.

Renewed interest in motorship construction has recently been shown by the Union Plant of the Bethlehem Shipbuilding Corporation of San Francisco, and Mr. Neitzel, Superintendent of Construction, has been abroad investigating the entire motorship and Diesel-engine situation. Recently Mr. Charles M. Schwab visited the Pacific Coast, and it is reported that he made a special trip for the purpose of taking up the question of constructing motorships at both plants.

CAR LOAD OF PISTON RINGS FOR PACIFIC COAST

An entire freight car load of American Hammered Piston Rings has just been shipped all the way across the country, from Baltimore to the Pacific Coast. The car contains nearly a half-million piston-rings of about five hundred different sizes, and will form a stock from which the company's Western Distributors can supply the piston-ring requirements in that section.

RETURN VOYAGE OF THE "KENNECOTT"

The new 6,000 tons d.w. motorship "Kennebecott" arrived at Los Angeles, Cal., from New York and Baltimore at 10 A.M., July 8th, having made the run from Baltimore in 19 days, her Diesel-engines operating perfectly during the entire voyage on regular boiler-oil of 16.7 gravity.

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MOTORSHIP

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PACIFIC COAST NUMBER

A considerable portion of this issue is devoted to past and recent development in the adoption of oil-engined commercial motor-vessels on the Pacific Coast, and the near-future conditions are enlightening and satisfactory. So far as the United States is concerned, the West Coast has always been the pioneer in the use of oil-engines for the merchant-marine. Being a younger section of the country may possibly account for the greater enterprise shown. It is to the credit of Pacific Coast men that the first All-American general-freight motorship was recently built on the West Coast (although her engines were constructed in the East), and that this vessel to-date has made a splendid record. Furthermore, she followed an All-American Diesel-motor tanker of half her size built in California. In her turn she is being immediately followed by a new Diesel-motor tanker very nearly her size, also All-American.

Nevertheless, this is not our intention to decry the enterprise of a great East Coast firm who previously built a large All-American Diesel-driven ore-and-oil-carrier, but about which extremely little has been revealed. But, complete success does not appear to have resulted. It is interesting to note that a considerable amount of new motorship construction and conversional work is contemplated to be carried-out on the Pacific Coast in the near future, including building an 18-knot Diesel-electric passenger and automobile ferry-boat. In fact, the Pacific Coast may soon be the centre of activity to a great motorship building boom.

TURBINE-ELECTRIC DRIVE FOR SHIPS

Last month we stated we would have something further to say regarding the Board's turbine-electric ships. From a fuel-consumption aspect this system cannot compare with Diesel-electric drive, and our contention was demonstrated by the performance of the cargo steamer "Eclipse" on a hundred-days' voyage. From a mechanical aspect we have no criticism to offer, as the reliability of modern steam and electric machinery is fully established, except that boilers and condensers often are more responsible for delays than Diesel-engines of to-day. It is from the economy point of view that our comments are directed, and the fact that nothing has been done by the Board to develop the Diesel-electric drive simultaneously.

Last month we briefly touched upon the voyage around the world of the "Eclipse," pointing out that her fuel-consumption is slightly over three times that of the Board's Diesel motorship "William Penn," and that it would have been 10 per cent higher had not superheated steam been used, and expert opinion has been put forward that superheated steam is inadvisable for marine turbines. The fuel-consumption of the "Eclipse" figured out at 1.28 lbs. per shaft h.p. compared with 0.40 lb. for the "William Penn." Available records of Diesel-electric drive show a consumption of about 0.60 lb. per shaft h.p.-hour, or about fifty per cent less than the turbine-electric system. Furthermore, after several years' service, the fuel-consumption of the turbine-electric drive ship will increase, whereas with the Diesel or Diesel-electric motorship the fuel-consumption will slightly decrease with each year of operation until a standard and definite figure is reached and maintained.

Altogether the Board has arranged for twelve geared-turbine ships to be converted to turbine-electric drive, and five contracts have actually been awarded. Yet, the Board has not contracted for a single vessel to be converted to Diesel-electric or direct-Diesel drive—not even for the purpose of giving the system a trial. No answer has been made as to why money was not made available for this purpose for at least one experimental ship. Both direct-Diesel and Diesel-electric methods of propulsion can show great economies over oil-fired geared-turbine machinery and over turbine-electric. Although at the present time the first cost of the turbine-electric machinery is lower, which is offset by it occupying more space, so that less cargo is carried. We herewith append some data concerning the "Eclipse" and her operation.

S. S. "ECLIPSE"

Original Machinery

Curtis geared-turbine of 3,000 shaft h.p. with three Scotch Boilers having Milne Super-Heater of 50 degs. Fahr. superheat.

Results of Voyage With Original Geared Turbine

(Mostly heavy weather)

Distance 23,611 miles
Time 2,419 hours
Average speed 9.68 knots
Daily fuel consumption..30.04 tons
Consumption per shaft h.p..1.03 lbs.
Average power developed.....2,422

Present Machinery

Curtis Turbine of 3,180 shaft h.p. and an A. C. Generator of 2,350 k.w. at 3,000 r.p.m. supplying a 3,000 shaft h.p. A. C. electric-motor on the propeller-shaft.

Results of Voyage With Turbine-Electric Drive

(Mostly mild weather)

Distance 25,759 miles
Time 2,608 hours
Average speed 9.87 knots
Daily fuel consumption..33.03 tons
Consumption per shaft h.p..1.28 lbs.
Average power developed.....1,990

The better speed with the turbine-electric is due to her having met good weather, whereas her voyage with geared turbines was mostly through heavy weather.

There is no doubt but that the motorship "William Penn" will show much better results, and it is to be hoped that cargo to fully load her can be found in order that she will show her efficiency to the best advantage. She will be operated by the United American Lines after about a thousand faulty rivets are replaced in her hull; who also have been operating the "Eclipse." The "William Penn," making nearly two knots better speed, has a fuel-consumption of under 14 tons, although she carries more cargo than the turbine-electric ships.

Since the above was written we had pleasure in attending the trials of the Board's cargo ship "Archer," fitted with turbine-electric drive. Undoubtedly all those responsible deserve the fullest credit for having made a very excellent installation—clean and simple to operate, and compact in space compared with reciprocating steam-engines; although there is far more auxiliary machinery in the engine-room than is to be found in the average motorship. The latter, however, has no closer connection with turbine-electric drive than any other class of steam machinery as it has its part or parcel of steam power. The six-hour trials were run without a hitch, and manoeuvring was carried-out with great rapidity that equals the best Diesel-drive, the actual time to change from full-ahead to full-astern being about five seconds. Naturally, improvements have been made based on the experience with the "Eclipse," and we understand that the fuel-consumption has been reduced a little in the case of the "Archer," although figures had not been checked at the time of the trials.

NEW SHIPPING BOARD AND MOTORSHIPS

As yet the policy of Chairman Lasker of the Shipping Board and four of the Commissioners towards motorships has not been announced, but we believe that they are all very warm towards adoption of this economical power. Admiral William Benson and Commissioner George E. Chamberlain have already expressed themselves strongly in favor of motorship construction and conversion of existing steamers. Another strong friend of the motorship has come out in the person of Mr. Wm. J. Love, one of the two experts chosen by the Chairman to direct the operation of the Board's ships. In an announcement to the daily press Mr. Love stated that steps are to be taken to provide a fleet of motorships as part of the merchant-marine, and that the Diesel-engines which have been built for the Board would be used whenever possible when machinery replacements are required. It is expected that a definite motorship program and policy will be announced before our next issue goes to press, after the new Board has settled down to its work and has had time to make thorough investigation.

MORE SUBMARINES FOR U. S. NAVY

Although the general tendency of Congress is for economy, the importance of national-defence should always overrule economy, as the expenditure of an additional hundred-millions for this purpose may save another expenditure of billions. Without doubt or hesitation a fleet of modern cruiser-type submarines should be built for protection of our Pacific interests. Our submarines are noticeably behind those of other nations, regardless of the claim made by the ex-Secretary of the Navy during his office. Japan is building a formidable fleet of submarines and submarine-cruisers, some of which are understood to be triple-screw boats of 12,000 shaft h.p., propelled by three two-cycle Diesel engines of 4,000 horsepower each. Great Britain is experimenting with the equipping of one of the big 27-knot K-boats (originally turbine driven) with Diesel-engines, and the result will be most interesting if the Admiralty publishes the same, which we very much doubt.

Naval records show that during the last few months of the war the allied navies had the German submarine campaign well in hand. But, all reports seem to have overlooked the fact that during the particular period in which submarine warfare lost some of its deadliness, Germany was on her last legs, morale in her navy was at a low ebb, so she was not capable of operating and maintaining submarines in the same conditions as when their submarine warfare was at its height. It is not difficult to imagine the seriousness of a big submarine campaign commenced by a country not demoralized by internal troubles, but with her navy at its height of efficiency.

Proposed Diesel Electric Ferries for San Francisco

ONE of the transportation companies of San Francisco Bay that has become convinced of the advantage and economy of the heavy oil engine as a motive power for its boats is the Golden Gate Ferry Co. of San Francisco. Harry E. Speas, president of this company, recently announced that the propelling machinery of several new ferries which the company plans to build for service across the bay would be of the Diesel-electric type, as he had become convinced that by using this method of propulsion, a saving could be effected of at least \$50,000 a year per boat in fuel alone, as compared with steam ferries making the same speed.

The introduction of boats of this type in the ferry service on San Francisco Bay would be a significant step, as all of the heavy freight and passenger traffic across the bay between Oakland, San Francisco, Alameda, Berkeley and the other Bay cities, is handled by ferry boats, and it would only be a question of time with the competition of Diesel-driven vessels until all of the big ferries of the Key Route, Southern Pacific and other companies would have to be equipped with similar power in order to hold their own in economy of operation. In practically all the Bay ferries at present, most of which are double-end screw-propeller boats, the prime mover is a reciprocating steam-engine driving a single shaft with a wheel at each end, a very inefficient arrangement, amounting to only 50 to 60 per cent of the efficiency of a steamer of the same form and size with the power concentrated at one wheel in the stern, and having, of course, a high cost of operation as compared with a Diesel-driven boat.

In the new ferries a double economy will be effected, for not only will the motive power be supplied by oil-engines, but separate electric motors will be supplied for each wheel, which will reduce materially the horsepower required. For instance, one of the steam ferries with wheel at each end attached to the same shaft recently lost one of her wheels, and was compelled for a time to operate on only one propeller. It is a fact that with less consumption of power, she made the trip in the same running time she had been making previously, but of course lost her efficiency in manoeuvring at the slip. This led to experiments which showed that with both wheels in operation, one at each end, to make a maximum speed of 14.77 knots required 3,010 i.h.p., while with the forward wheel off, the speed was made with 1,740 h.p. The reason for this is that a propeller forward exerting a powerful pressure upon the water stream increases the hydrostatic pressure at the bow, and increases the resistance of the water to the passage of the hull, so that the energy put into the wheel at this point is practically lost.

With the use of the Diesel-electric drive it will be possible to operate each wheel with a separate motor where the speed can be controlled independently, which will permit a very large proportion of the power to be delivered to the propeller in the stern of the ship, and only enough applied to the bow wheel, when the vessel is under way to eliminate skin friction. This would give better speed for the same power, and still give the boat the advantage of the forward wheel for manoeuvring in making landings.

The new ferries will have a length over all of 220 ft., an extreme breadth over the guards of 64 ft., a beam at the water line of 40 ft., and a depth of hold of 17 ft. 3 in. The displacement will be approximately 910 tons.

The power will consist of two Winton - Diesel - Westinghouse electric generator units, giving

an available s.h.p. of 810, which it is calculated will drive the boats at a speed of 11 knots. 250-volt generators will be used, which will be separately excited machines with armature current flowing in closed circuit from the two-generator armatures to the armatures of the two motors in parallel. Separate exciters mounted on the ends of the generator shafts will be compound-wound for 125-volt direct current, constant potential, one exciter having capacity for carrying the entire load of the fields of both generators and both motors.

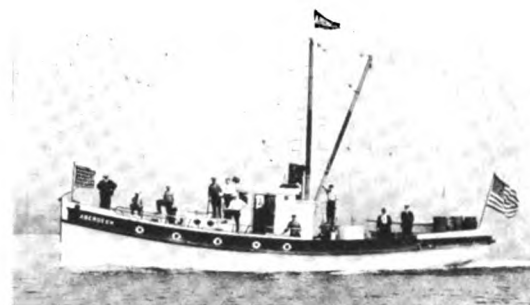
The excitation of the fields of the main driving motors, which are shunt-wound, is governed by means of a rheostat operated in such a way by a contactor controller that the speed of the motor can be maintained at any rate desired, and the speed control of the installation is governed by the excitation of the generator fields, the field circuit being extended to rheostats under the pilot house floor. The varying resistance of these rheostats is introduced by a controller operated by the navigator, so that the vessel may be manoeuvred at any point from full speed ahead to astern by direct electrical control from the pilot house. The astern action is obtained by reversing the field current so that full power is delivered to the wheel forward and the reduced power (about 71 h.p.) to the wheel aft.

The economy in fuel and saving of power and the absolute ease in control and manoeuvring offer advantages in this type of ferry which will undoubtedly cause their records to be watched with much interest by other ferry companies on the bay, and also by ferry operators on other waterways of the country.

NEW DIESEL-POWERED TUG-BOAT "GRIZZLY II"

"Grizzly II" is one of the most interesting work boats built this year on the Pacific Coast. Not only is she a well designed and well constructed craft, but she is equipped with the first of the new Enterprise Diesel-type engines installed in the Northwest. In length, the boat is 65 feet overall, with a beam of 17½ feet and a draft of 8½ feet. She was built at the plant of Schertzer Brothers on Lake Union, Seattle, the lines having been designed by L. H. Coolidge and the arrangement of the boat being worked out by her owner, Frank Nordland of Ballard. Her owner will use her for charter either as a cannery tender or towboat.

The engine in the "Grizzly II" is entirely a product of the Pacific Coast, having been designed and



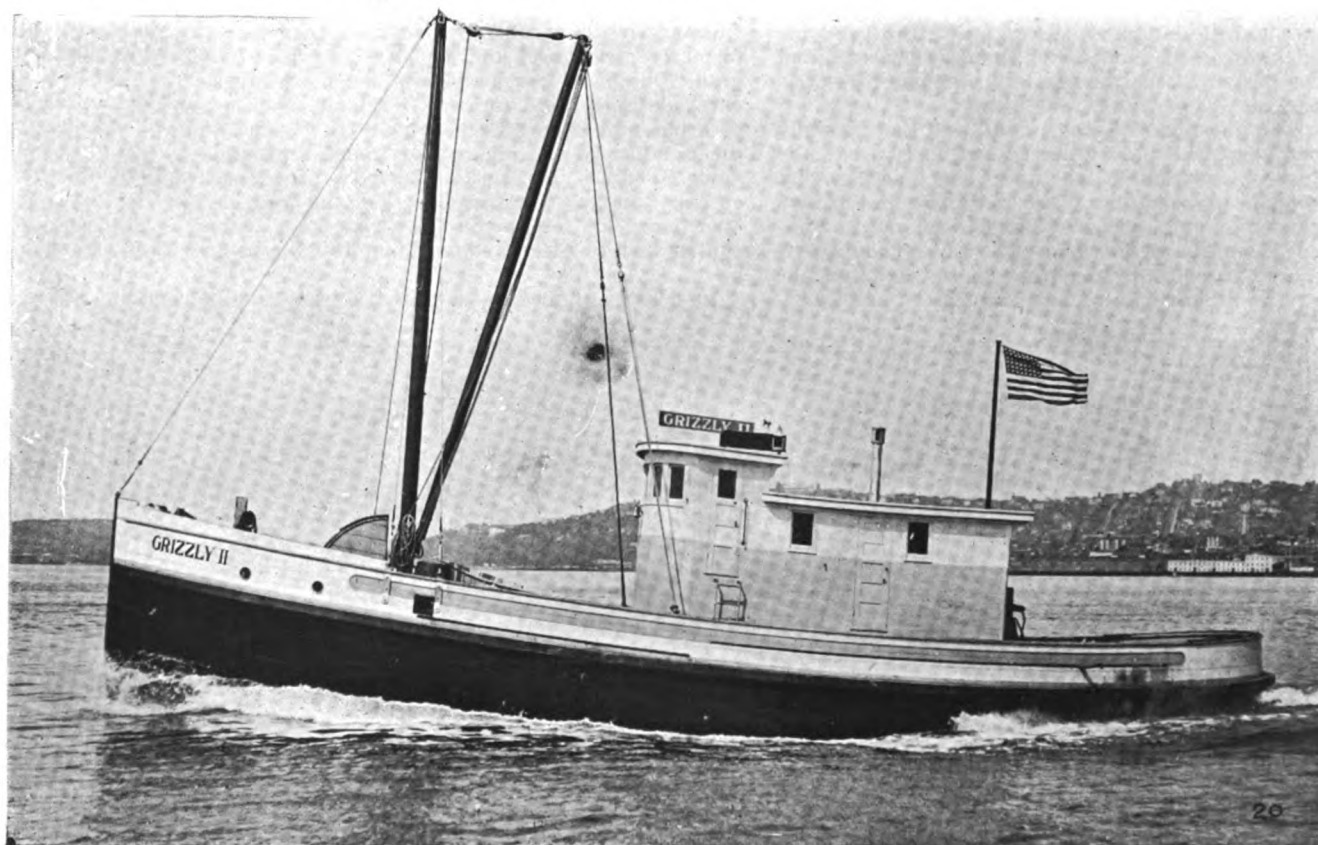
"Aberdeen," one of the first Puget Sound Purse Seine fishing boats to adopt heavy-oil-engine power. Many of the fleet since have had surface-ignition oil-engines installed

built by the Enterprise Engine Company of San Francisco. It is a 100 h. p. 4-cycle solid-ignition Diesel type, with four cylinders each having a 9¼-inch bore and a 14-inch stroke. Its normal speed is 325 r. p. m. The Enterprise Engine Company, in developing this engine, decided not to experiment but to use a proven principle, so they purchased the shop rights to use patents developed by John H. Suter which had been used and proven successful for four years in stationary engines of the Western type. The highest compression reached in the cylinders prior to injection of fuel is 520 lbs. which rises to less than 600 lbs. at time of injection. The engine is non-reversible but is equipped with an improved Enterprise heavy-duty reverse gear.

On the trial trip of the boat she operated very successfully and made a speed over a measured course of 11.2 statute m. p. h. In subsequent runs she has shown a normal cruising-speed of 10.54 m. p. h. The fuel consumption is 17 h. p. hours per gallon or a total of 515½ gallons per hour for the boat. With 16 gravity oil costing 5 cents a gallon or \$2.10 per barrel, the operating cost of the Grizzly for fuel is less than 30 cents an hour. The engine is equipped with a force-feed lubricating system which uses the oil over and over again, the lubricating-oil consumption being less than one gallon for eight hours, or 80 h. p. hours per gallon.

SAN FRANCISCO MOTOR FISHING-VESSELS

According to the reports issued by the Customs House for the year ending June 30, 1921, there are 3,374 motor fishing-boats engaged in the San Francisco district.



New Seattle-owned tug-boat powered with 100 b.h.p. Enterprise solid-injection Diesel engine

Development of the Nobel Diesel-Engine

ACCORDING to a recently published statement there were a year ago not less than 150 motorships of at least 2,000 tons capacity each in the course of construction, German production not included. Of these ships by far the majority, about 80%, were equipped with engines according to the four-cycle principle, but there is a growing tendency in favor of the two-cycle, which will readily be understood from the following.

Use of Diesel engines is to a certain extent limited by the size of the cylinder. Ordinary conservative practice has not dared to build much larger cylinders than of 30 in. dia. For this reason higher power required by large fast passenger-ships would mean too many cylinders, which would result in too complicated and cumbersome machinery with many chances of breakdowns and occupying entirely too much valuable space. As for practical reasons up to this time the diameter of the cylinder cannot safely be increased very much, it seems quite natural that attempts are made to obtain a larger power and with it a bigger field for the engine by making the engine double-acting or by resorting to the two-cycle principle. The first method is by all designers regarded with suspicion on account of the difficulty and trouble which a stuffing-box and a piston-rod going right through the combustion space involve, as well as of the difficulty of arranging the fuel-valves properly. But on the other hand the second method of increasing the power per cylinder by employing the two-cycle is finding many friends and has, as generally known, already brought forth a number of successful designs.

Advantages claimed by the two-cycle engine as compared with the four-cycle are in short the following ones: Less weight and less space occupied for the same power, easier and simpler means for reversing and maneuvering, less parts, less valves and consequently greater mechanical simplicity and with it greater reliability, better balancing with the same number of cylinders, also better or more uniform turning effort.

These advantages are of course more or less pronounced in the different designs. One prominent Italian manufacturer, Franco Tosi, Legnano, who has been building both four-cycle and two-cycle engines, cannot find any advantages at all for the two-cycle, but judging from the tests published, this manufacturer has not been very successful with his two-cycle engines and has not obtained as good results as other manufacturers. It must be remembered that, in spite of the greater mechanical simplicity, the design of the two-cycle engine requires far more skill and experience than the design of the comparatively simple four-cycle engine.

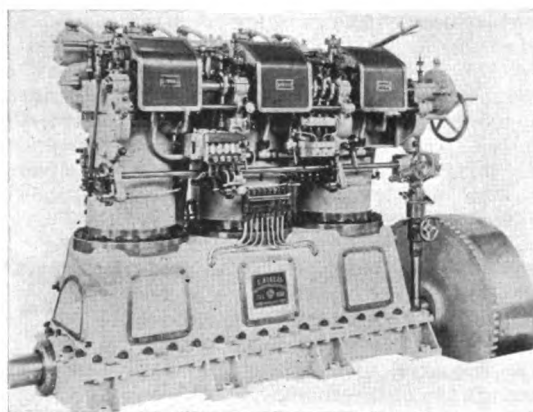
The most serious objection that is generally made against the two-cycle engine, is that the fuel-consumption is too high; but conceded that even in a well-designed two-cycle engine the fuel-consumption is about 5% higher than in a four-cycle engine of the same size, this advantage is more than offset by the decrease in weight and the saving in space which is so valuable in a ship.

The Nobel Engine of To-day, and a Resumé of Development Work of the Past With This Design—Progress of the Two-Cycle System at the Nobel Works

By EDWIN LUNDGREN

(Formerly Shop-Superintendent Ludwig Nobel Maschinenfabrik, Petrograd, Russia)

[Previous articles on Nobel-Diesel engine installations appeared in MOTORSHIP for November, 1916, March, 1917 and April 1917, but Mr. Lundgren's contribution contains much interesting unpublished information and illustrations.—EDITOR.]



The first Nobel direct-reversible 4-cycle type Diesel engine. It is of 120 b.h.p. and built in 1907

In due recognition of the advantages offered by the two-cycle a number of very prominent firms of the highest standing are devoting their energies to the development of large, reliable two-cycle engines. Among them we find: in the U. S. A. the Bethlehem Steel Co., the Busch-Sulzer Diesel Engine Co., Nordberg Manufacturing Co.; in France Schneider & Co., in England Doxford & Sons, Cammel Laird & Co., Swan Hunter & Wigham Richardson, Alexander Stephens, Walsend Slipway & Engineering Works, Denny Brothers; in Germany Maschinenfabrik Augsburg-Nürnberg, Howaldtswerke, etc.; in Switzerland Sulzer Brothers and in Sweden A. B. Atlas-Diesel and A. B. Nobel-Diesel.

The last named concern is in a way representing Russia, as it was started by Mr. Ludwig Nobel, formerly director of the Nobel Works in Petrograd, Russia, with a number of his most experienced designers and foremen. This Russian concern has ever since 1899 been actively engaged in the building of Diesel-engines. Backed by enormous resources the firm laid down a vast amount of experimental work, various designs and constructions, and has thereby in a very high degree contributed to the development of the Diesel engine.

In passing it may be said that Russia always

has been an excellent market for Diesel-engines, and—in that country all the prominent concerns of the world met in eager competition. It may be of further interest to state that during the war the Nobel Works had to repair several compressors belonging to some high-speed engines delivered by a prominent American concern to the Russian navy. While the workmanship was fairly good, the design showed some serious faults. The compressor-valves for instance were entirely too heavy and after only a short time running, they battered their seats to pieces and had to be replaced by valves of a superior design. This is mentioned to emphasize the value of using really experienced designers and also to demonstrate the fact that American shops often are liable to disregard the finer requirements of the design and to pay too much attention to the ease of manufacturing and machining of the details. This condition can possibly be responsible for the comparatively slow development of the Diesel-engine in the U. S. A.

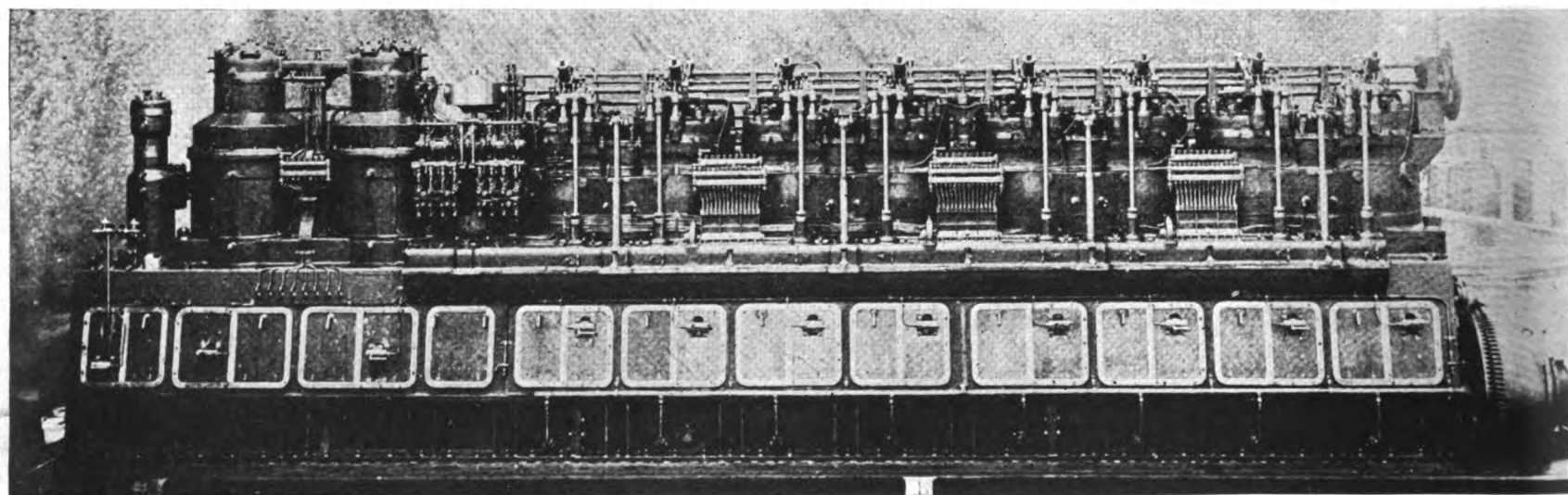
But to return to the development of the Diesel engine in Russia, it may be interesting for "Motorship" readers to recall that in the year 1904 the Nobel Works installed a Diesel-engine in the tank boat "Sarmat," on the Volga. The power was in this boat preferred to the propeller shaft according to Del Preposto's system, that is, the engine shaft was either directly coupled to the propeller-shaft or it was driving a dynamo and in that case the power was transferred electrically to a motor keyed upon the propeller-shaft. This was the first Diesel-electric drive in a ship.

In 1907 the first reversible four-cycle Diesel engine in the world was built by the Nobel Works. It was a three cylinder 120 H.P. engine, which was installed in the Russian submarine "Minoga," and in 1915 was doing in every respect satisfactory service. It is illustrated with this article.

Among other highly interesting Nobel constructions may be mentioned a 200 B.H.P. reversible marine-engine in which the eight-cylinders were arranged in V-shape and which weighed but 4,500 lbs. or 22.5 lbs per B.H.P. Further, a particular heat construction of a 150 B.H.P. 3-cylinder four-cycle engine which was installed in a small submarine and which had to conform to exceedingly rigid specifications of the Russian navy. It weighed only 2,000 lbs or 40 lbs. per H.P., was working very efficiently and running as smoothly as a watch.

While nearly all stationary and all submarine engines were built according to the four-cycle principle, the two-cycle was not entirely neglected. In 1903 an experimental two-cycle engine developing 15 H.P. was built and gave fair results, but as the shop at that time was very crowded with orders for its other types, the work was not immediately continued.

In 1913 a 320 H.P. two-cycle engine of very original design was built according to the ideas of Mr. Axel Lagersten, Chief-Engineer of the Nobel Works. This engine is still working daily supplying the machine shop with power.



First picture to be published of the 1,320 shaft h.p. 2-cycle type Nobel Diesel engine for Russian submarines

Large Opposed-Piston Engine

At the same time work on a large Junkers Diesel-engine with opposed-pistons was started and many parts for it were already finished when the great war broke-out and pushed other then more important tasks ahead. It may be said, however, that this construction although it has given remarkably good results in England, was regarded with a certain apprehension on account of its mechanical complicity, as it has a three-throw crank and three connecting-rods for each cylinder.

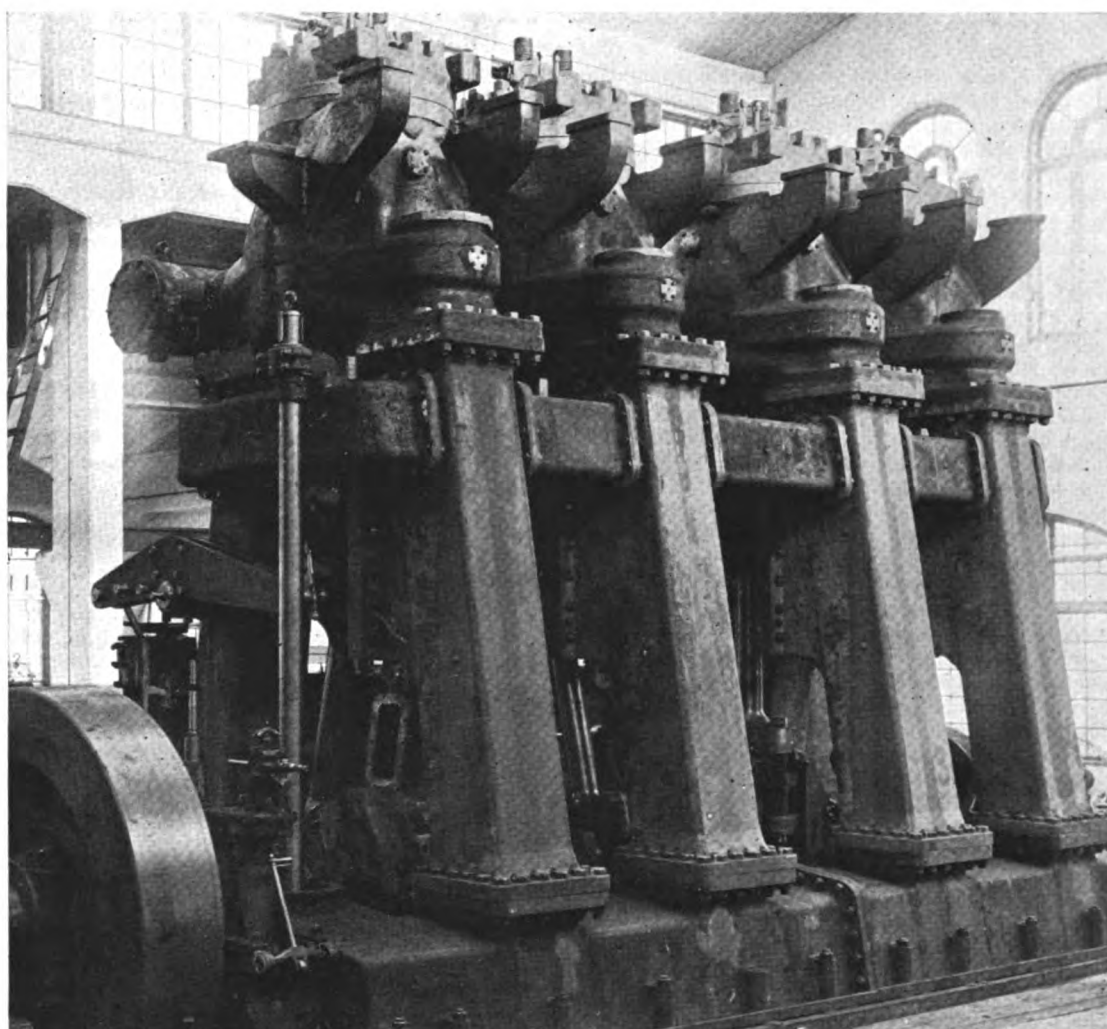
[We did not previously know that Nobels had commenced construction of a big Junkers-type opposed-piston oil-engine. Thus we all live and learn.—*Editor.*]

Of particular interest and characteristic of the thorough methods with which the various problems in connection with the two-cycle were attacked were a series of experiments undertaken in order to determine the influence of different factors upon cylinder scavenging. In these experiments a glass cylinder was used of the same dimensions as the actual working-cylinder with inlet and exhaust ports, and with a piston of proper shape moveable in it. This cylinder was filled with exhaust-gases taken from an engine on the test stand and stored in a reservoir. By taking a sample from the gas in the cylinder and analyzing it, it was made sure that the gas had the ordinary composition of exhaust-gases. The scavenging-ports were connected to an air-tank in which air of a certain pressure was kept and opened and closed again by the piston just like in actual service. The speed of the piston was accurately recorded by a registering device. After one scavenging had been tried, again samples were taken from three different points of the interior of the cylinder and analyzed. By now systematically changing one or the other factor, it was ascertained which air-pressure gave the best results, which form and dimensions the inlet and exhaust ports should have, which shape of the piston head was the most favorable one, what influence the piston-speed could have and so forth. It was also found that under certain conditions the scavenging was perfect, that is, all the three samples taken showed the composition of pure air.

The first two engines according to Mr. A. Lagersten's design which were built for a customer's order were two engines each developing 600 B.H.P. at 210 r.p.m. and intended to supplant the steam-engines of the passenger ship "Imperatriz Aleksandra," belonging to the steamship and transportation Company Kaukas-Merkur. These engines showed such good results during the trial tests and embody so many original and good ideas that they deserve general attention and a short description of them should be justified. They were illustrated in "Motorship" of March, 1917, together with details of the ship, but no description of the engine design was given at that time.

General Arrangement and Main Dimensions

The engines are arranged symmetrically to each other in two separate units, each consisting of 4 working-cylinders, in front of them a double-acting air-pump for the scavenging air, a three-stage compressor for the high-pressure air for injection and maneuvering and finally upon special



First picture of the 1,600-1,800 shaft h.p. 2-cycle type Nobel merchant-marine Diesel engine. Some interesting new features of design are incorporated in this engine. This engine has just completed erection at Nynashamn, Sweden

order a single-stage compressor which delivers compressed air for various purposes on board.

Output of engine at 210 r.p.m.	600 EHP
Working cylinders:	
Diameter.....	410 mm (16 1/8")
Stroke.....	500 mm (19 3/4")
Scavenging-air pump:	
Diameter.....	710 mm (28")
Diameter of lower guide cylinder.....	210 mm (8 1/4")
Stroke.....	500 mm (19 3/4")
Three-stage Compressor:	
Diameters.....	330, 295 and 70 mm (13", 11 1/2" and 2 3/4")
Stroke.....	360 mm (14 1/4")
Auxiliary Compressor:	
Diameter.....	220 mm (8 3/4")
Stroke.....	360 mm (14 1/4")
Length of engine, over all.....	6,000 mm (19' 8")
Height of engine, over all.....	2,600 mm (8' 6")
Width of bedplate.....	1,500 mm (5' —)
Total weight of engine, excl. flywheel	32 ton—53 kg—HP (118 lbs—BHP)

Details of Construction

All details are characterized by their simple rational design in which due attention was paid to the requirements of the foundry and machine shop.

The bedplate is made of cast-iron, and is entirely closed in the bottom. It consists of two parts, the main part under the engine proper and a lighter section under the air-pump and the compressors.

The crankshaft is also composed of two parts; the lighter shaft of the air-pump and compressors is connected to the main shaft by means of a flange coupling. On its other end the main shaft carries a light flywheel, 1.25 m. in dia. (about 4 ft.), which at the same time forms one half of the coupling to the propeller-shaft. This coupling can be taken apart within a very short time, if this should be desirable for a thorough examination of the engine. The throws of the 4-cranks are arranged at 90 deg. and 180 deg. to each other. Consequently the engine can be started regardless of which position the crank occupies. In a two-cycle engine this can be achieved with a smaller number of cylinders than in a four-cycle engine.

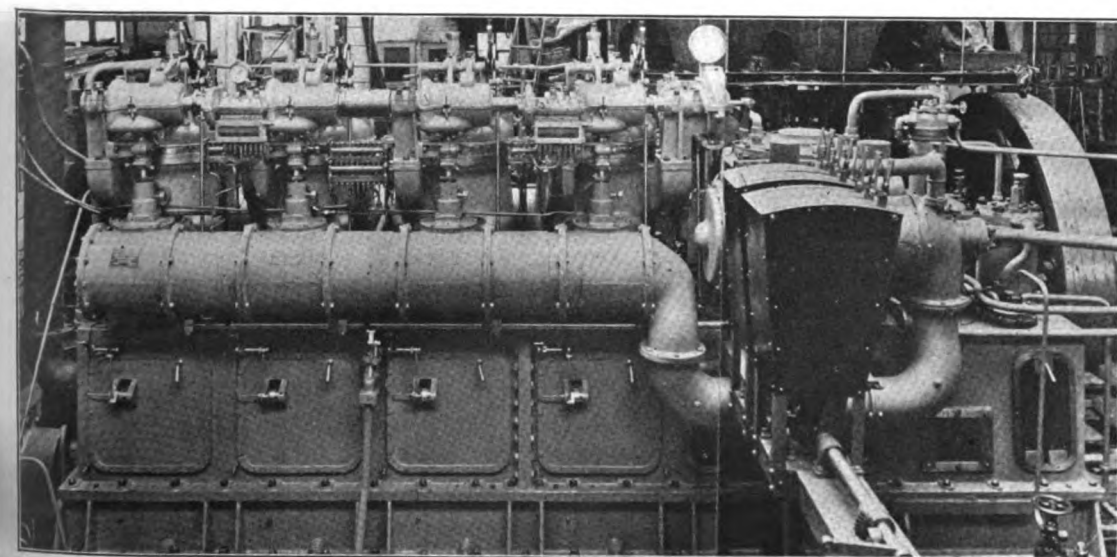
The connecting-rod is of the standard marine type and adjustable by means of shims. Its length is 5 1/2 times the crank-throw.

Pistons are watercooled, which has proved to be necessary for this size and kind of engine. The cooling-water is admitted and carried off by a system of pipes which are united to form a rigid trussed frame-work, fastened to the piston. The outer telescopic-pipes are moving in the stuffing boxes of air chambers attached to the frame of the engine where they always are easily accessible.

The frame is of the ordinary box type and kept relatively light, as the working-pressure is taken-up directly by ten 3 in. bolts which unite the cylinder with the bed-plate. Through large openings with easily removable doors the interior of the frame is conveniently accessible.

The main cylinders are arranged singly; they consist of two parts, one outer jacket and one inner cylinder bushing which is forced into the jacket while this one is slightly heated by steam. The inner cylinder is provided with ports for the scavenging air and the exhaust gases. As indicated above the size and location of these ports have been chosen after extremely carefully made experiments.

(To be continued in our September issue)



Nobel 2-cycle Diesel engine, 600 shaft h.p., showing receiver for scavenging-air, valve-gear, and manoeuvring-levers

Discussion of Diesel Engine Paper by Metten and Shaw

IN our June issue we published an interesting paper read before the Society of Naval Architects and Marine Engineers by Messrs. Metten and Shaw. An interesting discussion followed this meeting.

Mr. Benjamin C. Fernald stated that he agreed with their conclusions as to both reliability and fuel-economy of certain types of Diesel-engines, and that this power had unquestionably established its rights to fair and equal consideration of its merits. However, he criticised the operating data furnished by Messrs. Metten and Shaw, which he stated was based on a specific ship on a specific route and showed the motorship to be a better investment than turbine-operating steamers. He pointed out that in obtaining authentic records of performance and operating costs there is seldom that degree of co-operation between builders and operators of ships, which is necessary to accomplish the ultimate end of all commercial activities; namely, earning the highest return on a given vessel.

Mr. Fernald furthermore said he could not agree that continuation of the American merchant-marine would depend upon the wholesale conversion of the propelling equipment of steamships to Diesel-engine drive, or the building of new motorships—and that it was his opinion that such a conclusion was not warranted by a critical analysis for one ship for one trade route. Assuming equal reliability and flexibility of operation, he pointed out that a type of machinery must have the advantages of all the following six points over all others to be recommended for universal application.

1. To deliver a unit of power with less fuel and supplies.
2. To have a lower first-cost installed (including any extra cost of hull construction).
3. To weigh less.
4. To occupy less space.
5. Require lower operating labor cost.
6. Lower maintenance cost.

The real reason for the abnormal delay in the development of the Diesel-engine, said Mr. Fernald, was because it was inherently weak on points 2 and 3; namely, first-cost and weight.

On these matters we cannot agree with Mr. Fernald, because the larger cargo-space of a motorship reduces the first-cost of the motorship per net-cargo-capacity-ton to practically the same as that of a modern steamship; even though the Diesel machinery costs more than that of a steamer. Secondly, there are many well-known successful Diesel-engines whose weights are less than that of steam machinery, and which occupy considerable less space. The average weight of ten leading cross-head-type Diesel-engine is only 339 lbs. per shaft horse-power.

We draw Mr. Fernald's attention to the table of weights and dimensions of well-known Diesel-engines in our issue of April last, or in the Motorship Year Book, which confirms our figures.

Mr. Fernald evidently overlooked the question of the supply of coal-tar oil and vegetable-oils for Diesel-engines in the event of anything occurring to the world's supply of mineral oils, as he pointed out that economical conditions may bring about a reduction in the cost of coal and wages of firemen without corresponding degrees in the price of fuel-oil. He also overlooked the fact that widespread adoption of the Diesel-engine would make America's fuel-oil supply last three times as long, even before it became necessary to turn to tar-oils or vegetable-oils.

Finally, Mr. Fernald gave a summary of the investigations he made for a foreign client on the Diesel-engine situation in November, 1919. He stated that a complete operating analysis was made, based on a 8,800 tons vessel in service between San Francisco and Tokyo, and the operating balance sheet showed advantages of a net operating-service of 10 per cent for the geared-turbine over reciprocating steamer engines, and 9 per cent over the Diesel-engines.

We suggest that there must be something radically wrong with his basic figures, where the motorship is concerned. He stated he was submitting copy of this balance-sheet for printing in the Society's Transactions, but as yet we have not had an opportunity to see the same, so

Conflicting Statements Are Made— Some Misleading Figures Quoted

cannot offer further comments. Mr. Fernald stated that there were many half statements published in the technical press, misleading from their incompleteness, and were publications seemingly conducting propaganda in favor of certain types of propelling-machinery. Then he referred to the Hague report on comparisons of motorships with steamships. At the time the report was made we protested to the Shipping Board against its adoption, because the figures were inaccurate, owing to being formed on an incorrect basis and omitted many factors.

Mr. Chester B. Mills, Chief-Engineer of the of the Sperry-Gyroscope Company, gave some interesting details regarding the development of a compound oil-engine by Mr. E. A. Sperry, which had a number of new characteristics, including low capital charge because of the greatly simplified construction, low weight per b.h.p., great economy of operation, and with a noticeable saving in machinery space. He stated that this engine with the same revolutions and power is one-third and one-fourth and will occupy one-third the boiler space. Efficiency is gained through the carrying out of compression and expansion of two stages, with expansion to practically atmospheric-pressure, resulting in absence of noise, and burning ordinary bunker-oil without smoke. Also high speeds up to 1,500 r.p.m. are perfectly practicable in conjunction with the electrical magnetic-clutch they have developed. Details of this, by the way, have been published in "Motorship."

To illustrate his remarks Mr. Mills showed a slide of 180 h.p. engine turning at 400 r.p.m. connected to an electric generator, which engine has been operated over 2,000 hours with every satisfaction. One of the slides illustrated pistons of the engine and showed the proportionate size of the high-pressure cylinders and low-pressure cylinders, the two high-pressure cylinders exhausting into low-pressure. The engine operates on the four-cycle principle.

Mr. John Martin said he had represented the American Bureau of Shipping on the sea-trials of the motorship "William Penn," and that the machinery in this vessel operated and maneuvered perfectly, with noticeable absence of vibration in all parts of the ship.

Mr. William W. Smith, Chief-Engineer of the Federal Shipbuilding Company, referred to the question of converting steamships to Diesel power recommended by the authors of the paper. He stated that the entire replacement of the machinery is very expensive and the savings would have to be very large to justify this. He recommended the installation of super-heaters to steamships instead.

Mr. Smith referred to a consumption of 0.95 pound of oil being given by the authors of the turbines, which he stated was a good performance, but was not the best which could be obtained by using a higher degree of super-heat.

However, we point out that some turbine experts considered it very dangerous to use super-heat for turbines, particularly with reversing turbines. Mr. Smith referred to the 0.40 pound per s.h.p. hour having been given by Messrs. Metten and Shaw as the consumption of a Diesel-engine, and stated that for all purposes he allowed in comparisons made by himself 0.45 pound per shaft h.p. In this connection we would like to ask Mr. Smith if he has ever seen any four-cycle Diesel-engined motorship which has shown a consumption in service higher than 0.42 pounds per shaft h.p. hour for all purposes?

Mr. Smith then stated he noted Mr. Warriner used 0.515 pound per shaft h.p. hour for two-cycle engines, and that on that basis the fuel-consumption of the two-cycle engine is 7 per cent more than the four-cycle one, which would give 0.48 pound for the latter. However, we can frankly say that these consumptions are very high for a modern two-cycle engine. Practically

all the leading two-cycle engine-builders are now securing consumptions of 0.42 pound per shaft h.p. hour and even less.

We have before us the fuel-consumption report of the new Ansaldo-San Giorgio 4,000 shaft h.p. two-cycle marine Diesel-engine, and the builders state that the consumption is 0.405 pound per shaft h.p. hour, or 0.313 pound per i.h.p. hour. Furthermore, Sulzer-Freres guarantee a consumption not exceeding 0.42 pound per b.h.p. hour for their two-cycle type marine Diesel-engine.

Mr. Smith then gave some information regarding the comparison figures which he had worked out. He stated that he used the same number of men for both vessels, and as higher-grade men were required for Diesel-vessels, the costs were somewhat greater, and that he allowed fifteen men in both cases. Obviously this is incorrect, because of the absence of firemen on a motorship. There are many points we could criticise in connection with Mr. Smith's comparison, but unfortunately space does not permit. However, he refers to the weight and first-cost of the installation, both being extremely high. To this our comments on Mr. Fernald's statement above will apply.

It is curious that every steamship or boiler builder who makes a comparison always selects the heaviest and most expensive Diesel-engine on the market for comparison purposes, instead of taking a general average. In his comparison Mr. Smith makes no use of the advantage to be gained by a motorship selling bunker-oil as cargo, as in the recent cases of the "Buenos Aires," "Seminole" and other Diesel ships. Therefore, we suggest that Mr. Smith revise many of his figures.

Of the statements made during the discussion, those of Mr. J. G. Dalcher obviously showed the best balance and absence of prejudice. In giving his figures Mr. Dalcher drew attention to the design used in connection with his comparison, being based on conservative ratings throughout, taking into consideration that as this was to be the first venture in the motorship field he was justified in this step. He took as a fuel-consumption for the main Diesel-engines 0.43 pound per b.h.p. hour, 0.007 pound for the auxiliary oil-engines, and for the donkey-boiler 0.0312 pound per i.h.p. of the main engines, making a total of 0.35 per i.h.p. hour, or 14.55 tons per day for twin four-cycle engines aggregating normally 3,078 shaft i.h.p. at 105 r.p.m. While this consumption would be a little higher than the average motorship consumes, it is fair, in view of the reasons stated. The vessel in question had a displacement of 14,050 tons and a normal sea-speed of 12 knots. The steamer had turbines and reduction-gears developing 3,100 shaft h.p. at 90 r.p.m., oil-fired Scotch boilers fitted with super-heaters of 50° Fahrenheit. Taking the total operating costs per year of the steamship as 100 per cent the motorship's operating expenses were 94 per cent. The total net earnings of the motorship on initial investment was 119 per cent, compared with 100 per cent for the steamship.

Mr. W. Huskisson referred to a statement in the Metten and Shaw paper as follows:—

"The chief difficulties encountered with such a system are in getting good combustion at all running speeds and loads and the elimination of the shock in the cylinder, which is apt to occur with a sudden rise in pressure when fuel is injected."

This is a remarkable statement, said Mr. Huskisson, because no difficulties such as those mentioned have occurred. Fortunately, one of their ships happens to have arrived in this port today, so he took the opportunity of ringing up the chief-engineer and speaking to him on this point. He stated that during the voyage out they ran into a fog and had to reduce the revolutions from 118 to 80 revolutions per minute for over one day. He also mentioned that in coming up the Manchester Canal it was necessary to reduce the revolutions to 40 r.p.m. (this run takes about eight hours), and the combustion was perfect, as shown by the transparent exhaust at all speeds. He could

not understand why any sudden rise in the pressure of the fuel should be anticipated, as special means are taken to avoid this, and I think that the authors' fears of trouble on this score are born of ignorance of the subject.

The authors further go on to say that the advantage claimed is that the compressor troubles are entirely eliminated with a correspondingly higher mechanical-efficiency obtained than with air injection. This is quite true.

No one would think from this that the advantage mentioned was the only advantage that is obtained by the use of this system, but as a matter of fact there are many, and it was because of these advantages that Messrs. Vickers some years ago decided to abandon the use of the air-blast system. Since that time every single engine that they had previously built fitted with this air-blast system has been altered to the mechanical-injection system.

He briefly mentioned the advantages of the mechanical injection:

1. **Saving in weight**—In a high-duty light-weight engine of 600 b.h.p. a total net saving in weight of 4,887 lbs. is effected by the substitution of the small fittings required for the mechanical

spraying system, for the air compressor and its attendant complication of fittings and pipes.

2. **Saving in space**—In the case of the above engine, the overall length of the engine is reduced by 3' ft., while further space is saved by the omission of the h.p. and l. p. cooler pipes and their connections.

3. **Reduced cost**—The air-compressor is an expensive auxiliary to the engine, and in view of the simplicity of the mechanical injection system it follows that the relative cost of manufacture of the engine is less than that of the other type.

4. **Economy of fuel**—Consumptions down to 0.38 lb. per brake horse-power per hour, or 170 grammes per force de cheval have been obtained on ordinary official trials. This figure has not been attained in any other type of engine of which we have knowledge.

5. **Number of fittings and pipes reduced**—Less attention and adjustment of the engine are required as compared with the air-spraying system, due to the elimination of the valves and pipes in connection with the air compressor, relieving the engineers in charge of the engine and reducing the cost of upkeep and repairs.

6. **Economy of air for starting the engine**—Ex-

perience has demonstrated that the engine will get under way more rapidly with mechanical spraying than with air spraying, this effecting a considerable saving of starting air. Greater certainty is also obtained when manoeuvring the engine.

7. **Blast action on pistons**—There is a complete absence of blast or blow-pipe action on the piston top, and of local heating of the piston, both of which faults have a tendency to crack the pistons.

With regard to the high-speed Diesel-engines for the electric drive, the consumption of these engines is as small as that on the larger type. On looking through the official trials of over twenty submarine engines running at 380 r.p.m. the figures are in the neighborhood of 0.382 to 0.386 per b.h.p. per hour.

Of course, said Mr. Huskisson, every one must quite agree with the authors that if American ship-owners desire to run their ships in competition with European companies they must employ internal-combustion engines.

Mr. L. Armstrong, Mr. Edgar D. Dickinson, Mr. Robert Warriner and Mr. Alexander Schein also spoke.

Six-Thousand Tons Cable Motorship for Western Union Telegraph Co.

Diesel-Electric Drive to Be Adopted for Propulsion and Cable-Laying

SPECIFICATIONS have just been issued to shipbuilders for one of the most interesting steel motorships ever planned. This is a cable-laying ship of 6,000 tons displacement for the Western Union Telegraph Company of New York from designs by J. W. Millard & Sons, naval-architects also of New York. It is anticipated that the contract will be placed within a few weeks, unless the cost of construction is too high, in which event the vessel may be built abroad. In any event the order will be soon placed and the ship completed, as she is needed for work on the ocean.

It is very noteworthy that steam drive will not be considered for this ship, and that shipbuilders who have no Diesel-engine of their own must include in open bids the McIntosh & Seymour, Worthington, or other equivalent makes of Diesel engines that can be installed in the space available, in conjunction with Westinghouse electric transmission.

Coming at a time when steamship-building is suffering from a terrific slump this vessel will do much to center additional attention from shipbuilders on the importance of Diesel-engines for propelling purposes, as there are still about a dozen important American concerns who have not yet undertaken the commercial construction of Diesel-engines, although several have been negotiating for licenses or hovering on the brink of doing something tangible in this direction, including the Federal Shipbuilding Co., Bath Iron Works, Staten Island Shipbuilding Co., Merchants Shipbuilding Co., Texas Steamship Co. (shipyard at Bath, Me.) Moore Shipbuilding Co. South Western Shipbuilding Co., American Shipbuilding Co., Great Lakes Shipbuilding Co., and Downey Shipbuilding Co.

In this particular instance Diesel-electric drive is ideal, because the vessel will have to operate very slowly, except when proceeding to her destination at sea, which may mean only about four days at full speed. At times she will have little more to do than drift around, with most of the power shut down. With this class of machinery the standby charges will be very low, and at any time she is ready for full-speed ahead or astern in ten seconds, without being obliged to maintain a head of steam.

There will be two 1,000 shaft h. p. 500 volt direct-current electric motors connected to the propeller-shafting, and these will turn at 120 revs. per minute. Kingsbury thrust-bearings will be fitted. Current for the operation of the motors will be furnished from four 410 K.W. 250 volt direct-current compound-wound electric-generators driven by four 600 b.h.p. Diesel oil-engines.

For the auxiliaries there will be two 120 b.h.p. Diesel-engines driving two 90 K. W. 250 volt direct-current compound-wound generators at 375

r.p.m. These generators in addition to providing power for the auxiliaries of the ship, will provide current for two 250 volt, 1750 R.M.P. motors that will drive two 20 K. W. electric-light generators that will supply power for lights at 125 volts. They can also take current for the excitation bus. Power for lights thus will be taken from the auxiliary generators, through the motor-generator sets when at sea, and at such times as the auxiliary generators are being operated when in port. A small oil-engine driven 125 volts generator will furnish current for lights when the large auxiliary units are idle.

The general dimensions of the ship are as follow:

Displacement	6,000 tons
Gross Tonnage	3,000 tons
Power	2,000 s. h. p.
Registered Length	340 ft. 6 in.
Length B.P.	324 ft. 0 in.
Breadth (Moulded)	42 ft. 6 in.
Depth (Moulded)	25 ft. 0 in.
Register	Lloyds 100 A1
Speed	12 knots

We note that when using fuel having a heating-value of 18,000 B.T.U., the consumption at sea must not exceed 0.51 lb. per shaft horsepower per hour. This, of course, makes any form of steam-electric drive utterly out of the question even if the owner's specifications on page 14 (clause 3) did not definitely state that the propelling-machinery is to consist of four Diesel-engines driving generators.

However, we think that even for Diesel-electric drive the margin is too close, because the Diesel-engines will be of fairly high speed, namely 200 to 250 R. P. M. and so will have a fuel-consumption of about 0.45 lb. per b. h. p. hour, unless of the solid-injection type. To this an allowance must be made for the loss of power in transmission through the electrical apparatus of 12 to 15%. Therefore, if a consumption at the propeller-shaft, of 0.575 lb. were maintained it would be a very good result.

With direct Diesel-drive and slow-speed cross-head-engines consumption of under 0.42 lb. per shaft h.p. hour could be guaranteed, but the benefits to be derived from electrical drive probably outweigh the difference in fuel-consumption in this particular case. With any form of steam-electric drive the best consumption will be 1.15 lb. and there would be many other fuel losses when laying cables, because the boilers could not be shut down or started at a moment's notice, like the Diesel-engines. Consequently, we suggest that the specifications of the machinery be changed to read a consumption 0.60 lb. per shaft h.p. hour, or else protect the Diesel-engine builders by in-

serting a clause to the effect that the consumption must not exceed 0.45 lb. per brake horse-power hour, for they must not be held responsible for losses in the electrical transmission.

We note that complete sets of spare parts must be carried. For instance, each of the main Diesel-engines must have two sets of piston-rings for two cylinders, and one set of piston-rings for one piston of each of the two auxiliary engines. This in addition to four spare main-engine pistons and two spare auxiliary-engine pistons equipped with rings.

This will provide good business in these quiet times for piston-ring manufacturers, as it means about 56 spare rings of about 18 in. dia. and about 18 spare-rings of about 12 in. dia.

As the four main-engines will probably have six-cylinders each and seven piston-rings per piston, and the two auxiliary-engines three cylinders with six rings per piston, it means that no fewer than 168 piston-rings of 18 in. dia. will be on the main-engines when installed, and 36 of about 12 in. dia. on the auxiliary engines. Or a grand total of 224 rings of 18 in. dia. and 54 rings of 12 in. dia. including spares. We draw attention to this because there are a number of firms specializing in the manufacture of piston-rings who do not seem to realize the extent of business in this particular field today.

On deck there will be three electric-winches of the Lidgerwood, or other approved single-drum type, and an electric anchor-windlass. The steering-gear will also be electric and will be controlled by a MacTaggart-Scott telemotor and operated by a Waterbury hydraulic variable speed-gear. A Hasties friction rudder-brake will be installed. A Sperry gyro compass, and two 24 in. Sperry searchlights will be carried. In fact, the electrical equipment throughout the ship will be very complete and will include heaters in the officers' cabins, bath-rooms and saloon, 500-watt flood-lights, fans, bells, Edison storage-batteries, log and speed indicator. Other parts of the ship will be heated by steam from an oil-fired 9 ft. by 8 ft. donkey-boiler at 125 lbs. pressure. There will be two 2-ton refrigerating-plants of the Brunswick, York, or other approved type, electrically driven by a 250 volt D. C. motor. There also will be a Paracoll or other water-distilling plant.

When the contract for this novel and interesting motorship is placed we shall publish plans, and give further details regarding the auxiliaries and equipment.

THE LOMBARD DIESEL ENGINE

A new four-cycle type Diesel engine is being developed by the Lombard Governor Co. of Ashland, Mass., from designs by Mr. McCardy, formerly Chief-engineer of the Midwest Engine Co., Indianapolis. Details will shortly be published in "Motorship."

Interesting Notes and News from Everywhere

LAUNCH OF MOTORSHIP "SCOTTISH MAIDEN"

The 10,050 tons d.w.c. Diesel-driven motor-tanker "Scottish Maiden" was launched on July 7th by Vickers Ltd., Barrow-in-Furness to the order of Tankers Ltd., London.

SAYS MR. DE GANAHL

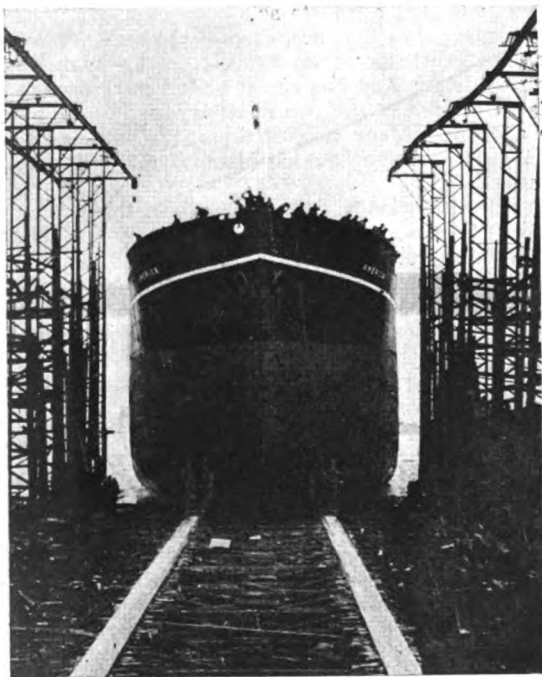
"Reflections have convinced me that every motorship launched is a greater force for the readjustment of the world's economic balance than all the artificial and political remedies that have been or can be applied. The nation that controls the greatest number of tons of oil and transforms that oil into power for engines will hold the economical trade of the world."—Chas. F. De Ganahl, President, Scottish-American Oil Co., Ltd., 120 Broadway, at the launch of the Diesel-driven tanker "Scottish Maiden."

THE NEW FRENCH SUBMARINES

Regarding the 36 submarines recently authorized under the new French naval shipbuilding program, the fleet will include submarine-cruisers, mine layers and a number of 800 to 1,000 tons surface-displacement craft.

MOTORSHIP CONSTRUCTION AT THE DEUTSCHE WERFT

On December 31, 1921, the Deutsche Werft A. G. Hamburg, Germany, had a total of ten motorships aggregating 61,200 tons d.w.c. on order with them. Burmeister & Wain type Diesel engines built by the A. E. G. are being installed.



Launch of motorship "America" at the Akers Shipyard, Christiania

LLOYDS MOTORSHIPBUILDING RETURNS

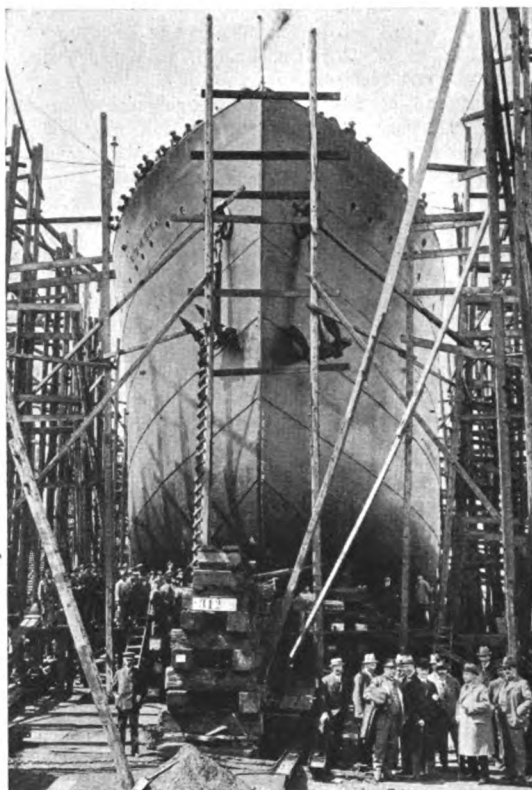
According to Lloyds shipbuilding returns for June 30, 1921, there were no fewer than 127 motorships between 100 and 10,000 tons gross actually under construction in the leading countries, excluding Germany. Outside of Great Britain there were 70 vessels aggregating 239,075 tons gross. In Italy there were 8 steel motorships building totalling 37,706 tons gross and 32 wooden motorships aggregating 10,740 tons gross.

LAUNCH OF MOTOR TUG

"Rocott," a 320 b.h.p. Bolinder oil-engined motor-tug of 75 ft. length, 16¼ ft. breadth and 8¾ ft. depth, was launched at Pollock's yard, Faversham, England, on July 7, to the order of A. J. Humphrey & H. Grey, Jr., of London.

BRITISH OIL-ENGINE TO BE BUILT IN INDIA

It has been reported that because of the increasing demand for motor-craft and oil-engines in India, the firm of W. & S. Pollock, Glasgow, Scotland, will establish oil-engine works and a shipyard in the Bombay district.



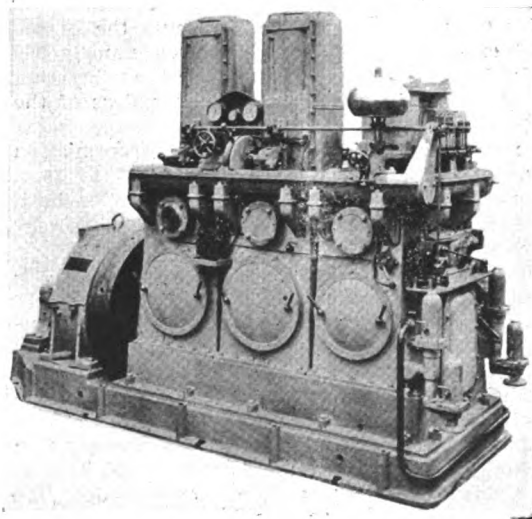
Motorship "Cometa" of the Johnson (Nordstjernen Line) just prior to the launch at Burmeister & Wain's shipyard at Copenhagen

STEAMSHIPS BRING NOTHING BUT LOSS—SAYS JOHNSON LINE

Authorization to sell abroad four steam-driven liners aggregating 24,400 tons gross has been applied for from the Swedish Government by the Johnson (Nordstjernen) Line of Stockholm. The company in its application states that it intends to purchase and operate motorships exclusively, because present steamship activity brings nothing but loss. The head of this company is Consul-General Axel Johnson, who recently visited New York in his motorship "Buenos Aires."

FIVE NEW MOTOR-TANKERS

Now under construction in Great Britain are five oil-engined motor tankers of 500 tons d.w.c. each, to the order of British Tanker Co. Ltd., and the first of these has run her trials. She was built by J. S. White & Co., of East Cowes, who are constructing two more of the fleet. She has been named "Perso," and is propelled by a 180 b.h.p. Kromhout surface-ignition oil-engine with four cylinders, 13-3/16-in. bore by 13-13/16-in. stroke, turning at 300 r.p.m. The length of this ship is 125 ft.; breadth, 25 ft. 6 in.; depth, 12 ft. 3 in.; loaded draft, 10 ft. 9 in.



Doxford opposed-piston auxiliary electric-generating set in engine-room of the motorship "Yngaren"

SECOND DOXFORD MOTORSHIP

The second Opposed-Piston engined-motorship for the Transatlantic Line now completing at the Doxford Shipyard, Sunderland, will be named "Eknaren."

FROM SCHOONER TO AUXILIARY

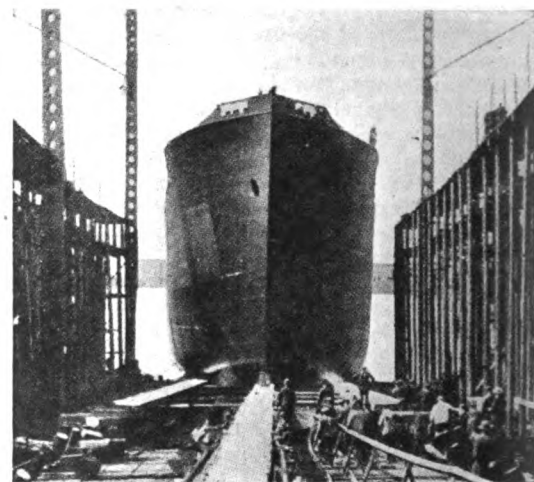
The 300 tons d.w. motor-schooner "Cargo Shipper" has been installed with a 150 b.h.p. Vickers-Petters surface-ignition oil-engine, to the order of Cargo Carriers Limited.

NEW WORTHINGTON ENGINE

A new engine for Diesel-electric drive purposes has been designed by the Worthington Pump & Machinery Corp. It will develop 750 h.p. and will have six cylinders 18-in. bore by 18-in. stroke at 257 r.p.m.

PAPERS READ ON MARINE OIL-ENGINES

Before the Institute of Marine Engineers on March 15 a useful paper was read by M. D. Shannon, entitled, "Some Observations on Marine Oil Engines." A discussion followed. A paper was also read by Lieut. Col. D. P. Lamb, entitled "Practical Notes on the Installation and Running of Petrol, Petrol-Paraffin, and Semi-Diesel Oil-Engines." Col. Lamb was responsible for the upkeep of about 600 marine types of internal-combustion engines in motor-craft on rivers in Mesopotamia during the war. Both papers are published in the June issue of the Transactions of the Institute of Marine Engineers, The Minories, Tower Hill, London, E., England.



Launch of Winge & Co.'s new Werkspoor Diesel-engined motorship "Geisha"

BACK COPIES OF "MOTORSHIP" WANTED

Any reader who has a copy of "Motorship" for July, September and November, 1919, will kindly oblige by communicating with Mr. Leigh M. Griffiths, Senior Staff Engineer, National Advisory Committee for Aeronautics, Langley Memorial Aeronautical Laboratory, Langley Field, Hampton, Va., who is very desirous of obtaining the same.

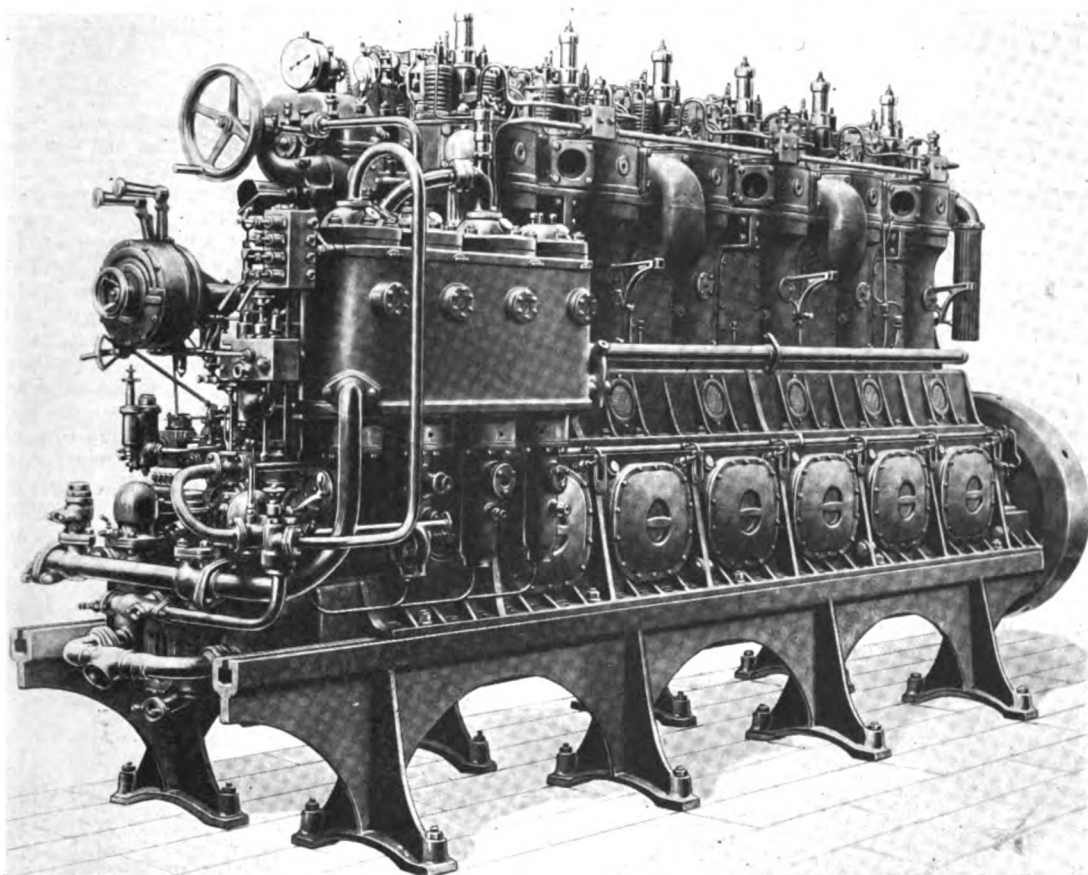
MOTORSHIP "GEISHA" LAUNCHED

One of the numerous Werkspoor-Diesel motorships ordered two years ago, namely the "Geisha," sister to the "Tosca" recently described and illustrated in "Motorship," was launched last month at the yard of the Netherland Shipbuilding Company, Amsterdam, Holland. She is a general cargo vessel of 6,850 tons d.w. c. and 10,260 tons displacement. Accommodation for twelve passengers in six two-berth cabins.

The main propelling engine consists of two 6-cylinder 1,400 i.h.p. Werkspoor Diesel-engines of the four-cycle type, which will give the ship a speed of 11 knots loaded on a fuel-consumption of 9 tons per day.

"MOTORSHIP'S" NEW ADDRESS

On July 1st "Motorship" moved into its new offices at the corner of Eighth Avenue and 25th Street, over the Baltic States Bank. We had intended using the Eighth Avenue number, which is 294 as indicated in our last issue, but for the convenience of callers and to simplify direction, we have decided to use the 25th Street number, namely 282. The telephone is Watkins 9848.



The new trunk-piston Diesel marine-engine built by Usines Renault, Billancourt, France.
Further details will shortly be given

24-Hours' Endurance Trial of 1,000 b.h.p. "Camellaird-Fullagar" Oil-Engine

A Fuel-Consumption of 0.391 lb. per B.H.P. Hour Recorded

Engine:—Four-Cylinders. Pistons 18½ in. diameter by 25 in. stroke. Rated at 1,000 B.H.P. at 115 R.M.P. Air-injection.

This engine ran steadily during the whole trial without a hitch or any signs of heating, and the power developed varied between 1,060 B.H.P. and 940 B.H.P., the variation being due to unsteady water pressure in the brake.

At the termination of the 24 hours' trial and continuous with it, a fifteen minutes' overload trial at 1,200 B.H.P., or 20% overload, was carried out, proving that all parts were in perfect condition.

Previous to this trial time had not permitted of more than two hours intermittent running on full load, and the preliminary tuning up was of short duration.

The average fuel-consumption was low, being only 0.391 lb. per b.h.p. per hour, and another notable feature was also the low scavenging-air

pressure of 1¼ lbs. per square-inch, which to some extent accounts for the low fuel-consumption.

The following are the average results for the 24 hours:

B.H.P.	1,000
I.H.P.	1,400
Mechanical-efficiency	71.5
Fuel-consumption	0.391 lb. per B.H.P. per hr.
Fuel-consumption	0.28 lb. per I.H.P. per hour
Scavenging-air pressure	1¼ lbs. per sq. in.
Blast air.....1st stage	40 lbs. per sq. in.
2nd stage	225 lbs. per sq. in.
3rd stage	1060 lbs. per sq. in.
Lubricating-oil pressure	12½ lbs.
Circulating-water pressure	20 lbs.
Temperature....Circulating-water inlet....	58° F
Circulating-water outlet....	94° F
Lubricating drain	94° F.
Piston-cooling water Upper....	102° F.
Piston-cooling water Lower....	66° F.

Fuel used....Anglo-American.....S.G. 0.92
Flash point above.....150° F

At various periods during the trial representatives were present from many engineering and shipbuilding firms, and also the superintendent engineers from numerous shipping companies.

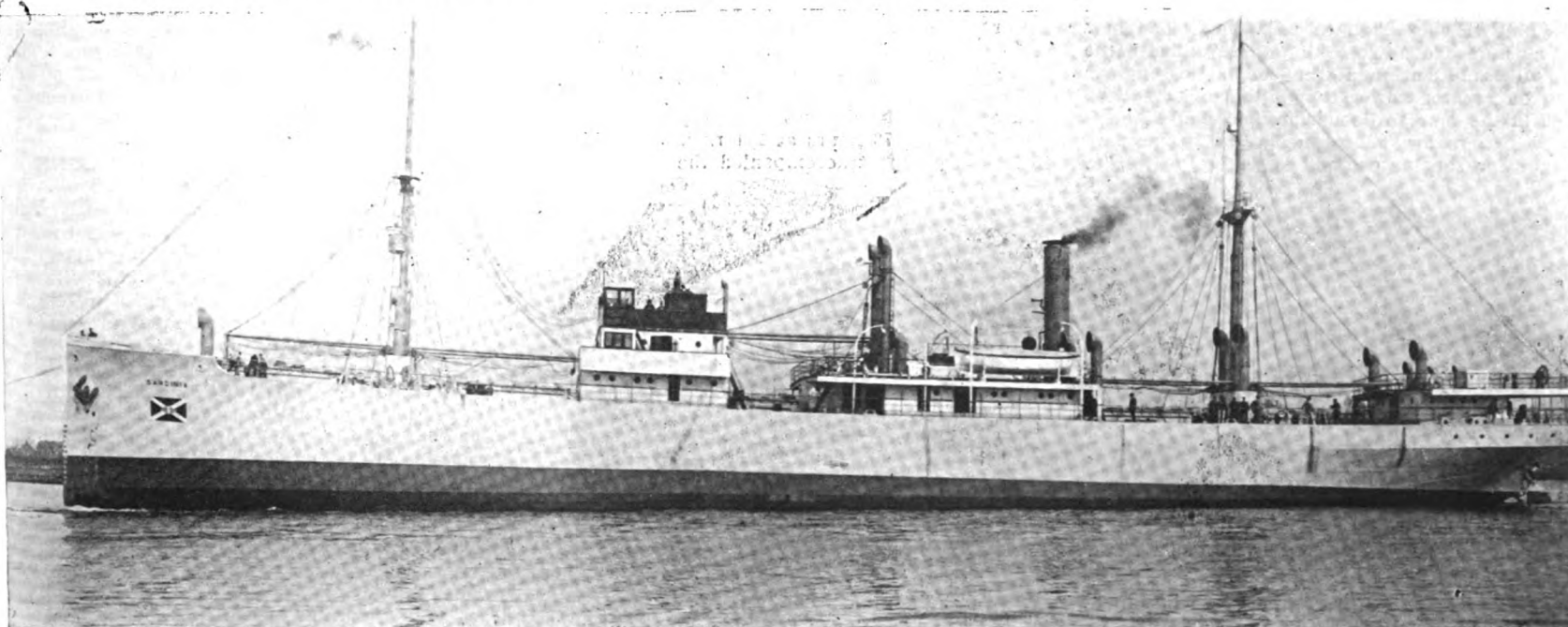
RECORD OF THE WOODEN MOTORSHIP "LIBBY MAINE"

One of the most remarkable performances that has been made by any motorship so far built for deep-sea service is that of the cargo vessel "Libby Maine," which is owned and operated by the Salmon Department of Libby, McNeil & Libby in salmon carrying and general freighting out of Seattle. It is claimed by the navigators, and so far as we have been able to determine is a fact, that this vessel, since going into commission, has made more actual running time than any other full-motorship type so far built in this country, having since her launching in 1918 travelled over 60,000 miles.

This record is especially interesting in view of the fact that the vessel was built on the Pacific Coast and is powered with Diesel-engines which are the product of a Pacific Coast factory and which, up until the time this installation was made, were practically unknown. The "Libby Maine" was built in 1918 in Portland, Oregon, by the Standifer Construction Co., and is a full-powered motorship, equipped with two 320 b.h.p. Dow Diesel engines, built by the Dow Pump & Diesel Engine Co. of Alameda, Cal. Her owners operate a number of salmon canneries in Alaska and also numerous fruit and vegetable canneries along the Pacific Coast and built her for the primary purpose of carrying supplies to these northern plants and bringing back salmon, and secondarily to carry salmon and other canned goods to the Atlantic Coast and foreign markets. When not engaged in any of the above work she has been used in general service and has made trips to South America and the Orient on several occasions. She will carry 50,000 cases of salmon or 2,000 tons of miscellaneous cargo.

In the time she has been in service she has proven not only very economical but also very reliable. When first put into service she burned on an average between 17 and 18 barrels of fuel daily, but a year ago a pair of specially-designed propellers were installed that gave her much better efficiency, and cut her fuel-consumption down to between 11 and 12 barrels. Never since the boat was placed in commission have her engines really been out of commission and the only repairs have been minor upkeep repairs made in port.

Since 1918, the "Libby Maine" has made sixteen different voyages, mostly to Alaska, although among them was a voyage to the Orient which totalled 14,170 nautical miles. A record of these trips, showing the distance covered, the time taken was published in "Motorship" a few months ago.



New single-screw 2,000 i.h.p. Werkspoor Diesel-engined motorship "Sardinia," described on pages 476-77 of our June issue

Electric Stoves for Ship's Cooking

TO-DAY the average motorship of five-thousand tons or over has at least 200 horsepower in auxiliary electrical-power which is used for various purposes, mostly for operating engine-room and deck machinery. Some motorships have as high as 1250 b.h.p. in electric generators and motors driven by oil-engine power apart from the main Diesel-machinery, as for instance, the "Domala" and other motor passenger-liners of the British India Steam Navigation Company, with which all the cooking, heating, power and lighting is carried-out by means of electricity.

Danish shipbuilders and shipowners were responsible for originating the use of electrical auxiliaries aboard motorships, and it will be recalled that the 7,500 tons d.w. motorship "Selandia" placed in service in 1912 dispensed entirely with steam for power, with the exception of a small donkey-boiler used for heating. So successful and economical did Diesel-electric auxiliary power prove, that practically every modern vessel of this class is now equipped in this manner, with the exception of a few tankers where a large quantity of steam is sometimes required for heating the oil-cargo. Nevertheless, in the port of New York tankers are prohibited by regulations from employing open fires in the galley or elsewhere on the ship during the loading of oil-cargo, so even on motor-tankers Diesel-electric devices play their part. To quote an example the Danish Diesel-tanker "Mexico," which carries bunker-oil for use of the big fleet of motorships of the East Asiatic Company, found her electric galley very useful when in port, and this avoided the necessity of the crew going ashore for all their meals.

The electric cooking-equipment installed in this vessel is quite of interest, and we are enabled to give some details and illustrations through the courtesy of the makers, the Vesta Electric Works, Ltd., Copenhagen, Denmark. The galley has a capacity for serving a crew of 30 to 40 men, and comprises three cooking-kettles, one hot-water accumulator, and two kitchen ranges. The electric-range has dimensions 400x620x900 mm. and is provided with an oven for baking and frying. There is one element each for top and bottom heat of respectively 3,000 and 5,000 watts, the total consumption of current aggregating 8 kilowatts at full heat development—the latter can be regulated in 3 stages by contacts. The oven is efficiently insulated on all sides.

Arranged on the oven plate are three cooking-plates of 175, 225 and 275 mm. diameters, for respectively 550, 1000 and 1500 watt, each being regulable in 3 stages. The switches are placed in

Electric Auxiliaries Aboard Motorships Cause Wider Adoption of this System

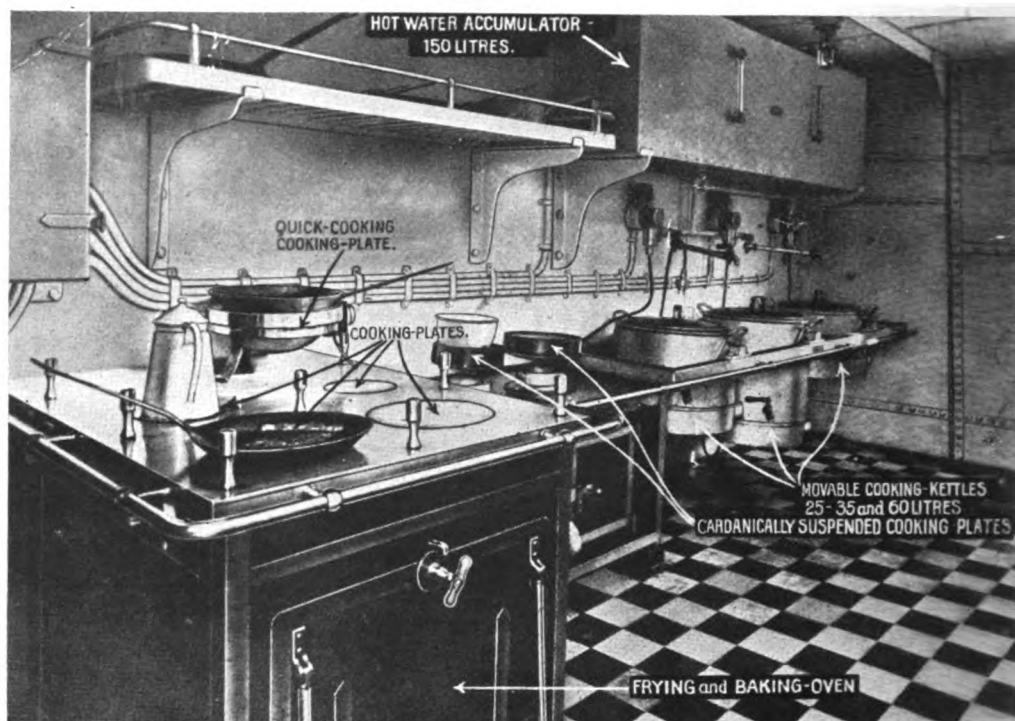
front of each plate and the provision includes further a roller frame.

The second kitchen range is fitted with two cooking-plates in cardanic suspension, the plates being regulated as just described. They are 225 and 275 mm. in diameter respectively, and are provided with a low gravity center which prevents the kettle and pan from slipping as a result of shocks or pushes. The three 4-kilowatt cooking-kettles are of 25, 35 and 60 litres capacity respectively with 3 pitch switches mounted on the kettles, which are made of tinned copper and surrounded by a massive non-conducting casing, equipped with plug-cocks and pivots for their suspension and thwart-movement.

The 3-kilowatt hot-water accumulator holds about 150 litres. It is fitted out as the kettles, further with partition, water glass gauge, thermometer and the necessary plug-cocks, inlet pipes,

etc. The cooking-kettles are connected with the fixed lines by means of flexible cables and water-tight branch contacts.

Among the extra apparatus supplied are two rapid cookers and a plate fitted with the new patented Vesta thread-pipe heating-body that is arranged direct below the bottom of the kettle. Very quick heating is attained which is mainly used for roasting. The total consumption with all apparatus in full operation amounts to 39.6 kilowatts. However, actual experience has proved that only one-third of the apparatus on an average is in use at the same time developing but half the heat, so that the actual kilowatt consumption is much reduced in daily service and can be neglected at sea when the generator set is already running. When accustomed to the electric system, few cooks desire to return to the older, dirtier and slower system. Electric galleys have been supplied by Vesta Ltd. to Russian submarines both before and during the war, also to the East Asiatic Co., Burmeister & Wain, the Royal Danish Navy and others. The company is now negotiating to equip American motorships.



Galley of motor tankship "Mexico" showing arrangement of the electrical cooking equipment

LARGE CYLINDER ENGINES

In an interesting paper before the Institution of Civil Engineers, London, dealing with Internal-Combustion Engines With Large Cylinders, Sir James McKechnie stated that so completely has the point of view changed regarding oil-engines that owners are now seeking to investigate the possibilities of marine internal-combustion engines of much greater power than hitherto have been fitted in the mercantile-marine, and that builders and designers are being encouraged to prepare designs for the largest and speediest vessels to

be constructed. Also, that orders for motorships in some cases are being carried-on while similar steamships have been cancelled.

Regarding cylinder sizes Sir James said that marine oil-engines up to 30 inches diameter are now running, and that there seems no reason to assume that they cannot be made with larger cylinders. He referred to a single-cylinder two-cycle double-acting Diesel-engine 30" dia. by 36" stroke built at the Vickers plant having developed 1,042 b.h.p. for 73 hours at 141 r.p.m. in 1913. A 10-days test report accompanied the paper. The

fuel-consumption dropped as low as 0.363 lbs. per b.h.p., which is very remarkable for a two-cycle engine. Copies of tests of an engine having 340 b.h.p. cylinder output at 375 r.p.m. were included in Sir James' paper. Also tests of one of the twin 1,250-shaft h.p. Vickers oil-engines of the tanker "Scottish Standard" were given. The aggregate i.h.p. was 1,760 and the brake power about 1,342.8 at 120.6 r.p.m. Sir James McKechnie is the Technical-Director of Vickers, Ltd.

RECENT PROGRESS IN LARGE MARINE DIESEL ENGINES

The above is the title of a paper recently read before the Institution of Civil Engineers by Mr. James Richardson. Accompanying the table is a very useful list of 20 leading motorships with various makes of Diesel engines giving their general dimensions and output. Unfortunately pressure on space prevents our publishing the same.

"MOTORSHIP" PRODUCES FRIENDSHIP

In a letter to the Editor of "Motor," a Swedish automobile and marine publication, Mr. Hugo Moren, one of the engineers of the Swedish motorship, "Elmaren," stated that when in Australian waters the pilot and himself became good friends after the captain loaned the pilot his copies of "Motorship." These, by the way, gave many on board a great deal of pleasure. Mr. Moren is the Swedish civil-engineer who took a position on board the "Elmaren" during the strike of ships' engineers in Sweden.



Motorship "Leise Merske" fitting out at the Burmeister & Wain shipyard. In the background can be seen the motorship "Malaya." The "Leise Merske" is of 3,015 tons gross, and is owned by the Svendborg Steamship Co. (See page 217, March, 1921.)

Injection and Combustion of Fuel-Oil

(Continued from page 567, July issue)

IN the case of the automatic-valve, shown in Fig. 13, it will be seen that the full fuel-pressure is close up to the point of exit of the fuel-oil from the sprayer. As soon as the automatic valve lifts the full available pressure causes a fine spray to pass the valve seat. When the valve lifts beyond a certain small amount the spray is formed by the oil being forced through the grooves G at a high velocity and the valve ceases to have any appreciable effect on the quality of the spray. Similarly when the valve closes the control of the spray is taken up by the valve end and a much finer spray is obtained at the instant of closing than is possible with the direct-lift type of fuel-valve. The spray past the valve-seat, as distinct from the spray resulting from the fuel passing through the grooved plate at high velocity when the valve is clear of its seat, can be made so fine that it has little or no penetrating effect, and therefore such a fine spray is to be avoided, at least in the case of high-speed engines. With the automatic-valve, therefore, the closing and opening of the valve should be as rapid as possible.

With the valve shown in Fig. 13 considerable trouble was experienced, as in the case of experimental valves of other designs, due to the inclination of the fuel-valve to the axis of the cylinder of the single-cylinder experimental engine. Experiments were made with different types of nozzle plates with the object of turning the spray, and although nearly 100 B.H.P. was developed at 380 R.P.M. the results were unsatisfactory. A very fine spray could be produced with the automatic valve, but the moment an attempt was made to deflect the spray the particles of oil coalesced and the energy of the spray was largely lost.

At a later date a new cylinder cover, designed to take a vertical fuel-valve, was fitted to the experimental cylinder. When the new automatic-valve was made it was tried in the atmospheric testing apparatus (shown in Fig. 10) and a very fine spray was produced. The shape of the combustion space of the experimental engine necessitated, however, the use of a spray of wide angle and it was found that considerable energy was lost in producing it. The valve was then tried in the experimental engine, with various numbers and sizes of grooves in the nozzle plate, but only 66 B.H.P. at 380 R.P.M. was reached satisfactorily. Better results would doubtless have been obtained had it been possible to use higher fuel-pressures; as the energy of the fine sprays produced would thereby have been increased, resulting in an improvement in the penetration, and consequently in the distribution, of fuel-oil in the combustion space. At low speeds the automatic-valve was very satisfactory and it was found that the engine could be run for long periods at 6 B.H.P. and 116 R.P.M., whereas with the direct lift type of injection-valve it was difficult to run the engine below 25 B.H.P. at 140 R.P.M. without misfiring. When the automatic-valve was in use at the lowest power an indicator diagram was taken with the pencil held on the paper during six successive injections of fuel and only a single line diagram was recorded, indicating that the firing was certain and regular, and that the automatic-valve was superior to the direct-lift injection valve for low-speed running.

From the experience gained it was evident that with an automatic-valve on the lines of Fig. 13 satisfactory results could not be obtained with the fuel-pressure used owing to the shape of the combustion-chamber of the experimental cylinder. To use solid-injection satisfactory it is necessary to pulverize the fuel-oil as finely as possible, and at the same time to produce a spray with sufficient penetration to ensure that the fuel is brought in contact with the air required for its combustion. Unfortunately these two requirements are incompatible and it is necessary therefore to effect a compromise—and this compromise can only be reached largely by trial and error. In the case of the automatic valve shown in Fig. 13 the pulverization was excellent but the penetration was poor i.e., the energy of the sprays, owing to their finely-divided state, was rapidly lost when they entered the compressed air in the combustion

Experiments With Solid-Injection and Air-Blast in Marine Diesel-Engines

By ENGR.-COMMANDER C. J. HAWKES

PART V

space, and this resulted in the presence of a rich mixture in the vicinity of the fuel sprayer; which was followed by late burning. The lack of penetration of the automatic valve sprayer was more marked as the angle of the spray was increased.

As it was not possible to modify the shape of the combustion space of the experimental engine without considerable structural alterations, or to employ higher fuel-pressures, the automatic valve described was put aside. In nearly all the fuel-valves subsequently experimented with at the

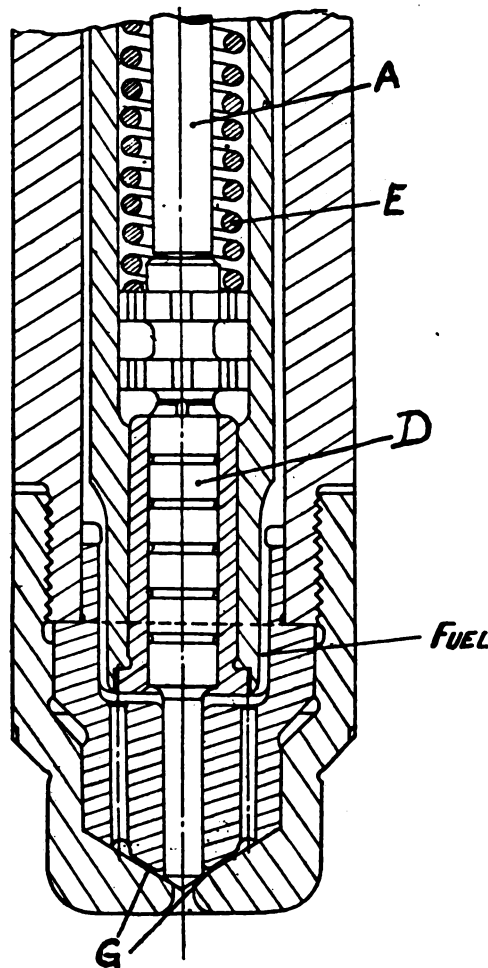


Fig. 13

Laboratory, both air and solid-injection, the principle of the automatic-valve was, however, retained; but in order to obtain the necessary penetration of the sprays multi-hole sprayers were employed on the lines of the direct-lift fuel valve previously referred to.

Referring again to Fig. 13 it will be seen that the plunger of the valve D has to be a very good push fit in the bush to avoid leakage at high fuel-pressures, and it is desirable for machining purposes that this plunger should be not much less than 0.5 inch in diameter. The spring which loads the spindle A must at least be strong enough to withstand the full fuel-pressure on the underside of the plunger D. In cases, therefore, where it is necessary to fit a plunger of a diameter much larger than 0.5 inch it might be desirable to fit a balanced type of valve and so avoid the use of a heavy spring. It might be mentioned that the common-rail system cannot be used with the automatic type of valve unless it embodies the principle shown in Fig. 13.

Good results have been obtained at the Admiralty Engineering Laboratory with solid-fuel injection but in nearly all cases shale fuel-oil has been used in the tests. A few tests were carried out with Texas and American distillate-oils and satisfactory results obtained but no other fuel-oils have so far been tested. It would be interesting to hear whether smokeless combustion has

been obtained with fuel-oils other than those referred to above, in an engine running at 380 R.P.M. and at not less than 100 lbs. mean indicated pressure. The problem is perhaps less difficult in the case of engines of slower speed working at comparatively low mean pressures.

Experiments were carried out with the object of ascertaining whether improved results would be obtained with the solid-injection system by increased turbulence, due to increasing the velocity of the air through the induction-valve. These experiments indicated that there was no improvement due to increased turbulence; in fact, the fuel-consumption was slightly increased and the exhaust was slightly shaded. In the explosion-engine ignition commences at one point of the inflammable mixture of air and fuel vapour, by electric spark or other means, and turbulence is essential for the rapid propagation of the flame. In the Diesel-type of engine the fuel-oil is sprayed into air which has been compressed until the temperature of the greater portion of it is above the ignition point of the oil. The time required for complete combustion is consequently dependent on the fineness of the spray, on the speed of vaporization of the oil globules and on the speed with which the oil vapour is brought in contact with the air required for its combustion.

On the face of it, therefore, it would appear that turbulence would also assist combustion in the case of the Diesel-engine—but it will be seen that a high degree of turbulence might have a harmful effect by distorting the spray and causing a portion of it to be brought in contact with the comparatively cool walls or cover of the engine before the oil globules had completely vaporized. This action would produce a smoky exhaust. It is very essential that a fuel spray should not strike a cool surface, and as a high degree of turbulence would have a tendency to bring this about it is considered that turbulence is not so desirable in the Diesel-engine as it undoubtedly is in the explosion engine. The turbulence referred to is, of course, that due to high air-speeds through the induction-valve and not to the use of blast-air in air-injection engines. Blast-air splits-up and distributes the fuel-oil in the combustion space, but its acts symmetrically about the centre line of the sprays and its direction of action is under control (depending on the position, size and shape of the holes in the distributor or flame plate); consequently it is much less likely to drive a portion of the fuel on to the cool walls of the liner and cover.

There is no doubt that solid-injection has much to recommend it, so long as it is in every way satisfactory on Service. By its adoption it is not necessary to make provision for an air compressor for supplying blast-air—and the high-pressure compressor, as is well known, has in some instances been a continued source of trouble. Air-injection is, however, principally used to-day and it seems fair to presume, therefore, that many manufacturers have largely, if not entirely, overcome their compressor troubles. So far as present experience is concerned it is considered that a greater variety of fuel-oils can be used satisfactorily with air injection than with solid injection. With the fuel-oils experimented with at the Laboratory it has been found that up to about 100 lbs. mean indicated-pressure the fuel-consumption with solid-injection is approximately the same as the fuel-consumption with air-injection, at the same power and speed, after taking into account the power required to drive the injection-compressor.

This means that whilst the consumption per B.H.P. is the same with both systems the consumption per I.H.P. is less with the air-injection engine than with the solid-injection engine—i.e., the combustion of the fuel-oil in the air-injection engine is slightly better than in the solid-injection engine. This difference is no doubt largely due to the better and more rapid distribution of the fuel-oil mist in the compression space which naturally follows the use of air for injection purposes, as the sprays have more energy, and the air when it expands in the combustion space carries the fuel-oil mist with it. Owing to the cooling effect of the injection-air, however, a higher compression is necessary with air-injection.

(To be continued)

Electro-Magnetic Clutch for Marine Oil-Engines

WIDER application of the Diesel and surface-ignition types of engines to certain classes of small commercial and pleasure boats has been severely limited in the past due to certain characteristics of the engines which render them somewhat unstable in control, or in other words, have insufficient maneuvering qualities to suit the small boat requirements, especially at slow-boat speeds. The accepted and orthodox method of solving this problem has been through the use of speed-changing gears involving mechanical clutches of various forms in order to adapt the Diesel engine limitations to the propeller speed requirements.

Characteristic defects of the orthodox types of mechanical clutches have been known and struggled with for many years with varying degrees of success, and have been endured because there has been no other device known to the mechanical arts which offered a reasonable hope of solving the vexatious problems constantly encountered. Engineers familiar with the installation and application of power-transmitting devices, have had in their mind's eye for years an ideal form of coupling which would be self-aligning without restraint and be flexible in torsion by the use of a "weight-less" spring.

These ideals have long been recognized and striven for and until the advent of the Sperry type of magnetic coupling have been impossible

Details of the Sperry Clutch Designed for Small Commercial and Pleasure Craft—Many Benefits Claimed to Be Secured by Its Adoption

By C. B. MILLS

Chief Engineer, The Sperry Gyroscope Co.

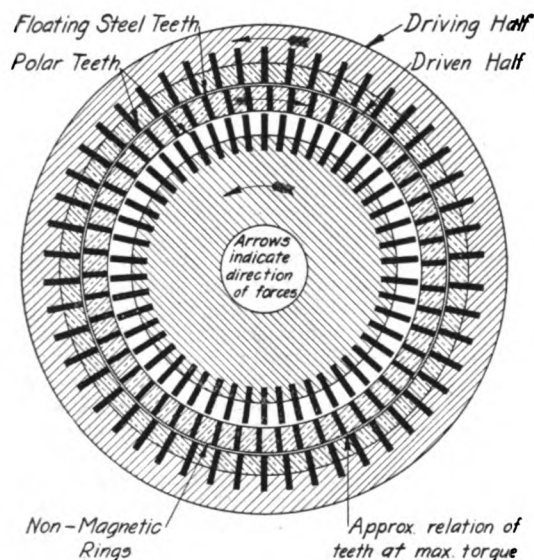
jected to shock of any kind and there is no liability of parts becoming loosened, worn, or broken due to the severest service condition.

The half coupling carrying the floating teeth is normally centered by a sleeve or ball-bearing projection from the opposite half of the coupling. This centering projection maintains a normal condition of the air gap and prevents exterior forces due to shaft misalignment or other conditions disturbing the proper relation of the coupling parts. The air gaps maintained in the coupling are relatively large and the floating magnetic-teeth are cast solidly in a non-magnetic ring which is made by a process insuring permanent retention of the teeth and safety against all of the working and handling conditions which may be encountered in assembly and fitting.

tions as a guard against overloading some particular part of the system. No detrimental effect is caused by starting continuously even under load.

The characteristic speed torque curve as shown in Fig. 4 will serve to illustrate very clearly the effect of the high conductivity metal surrounding the magnetic teeth. The torque due to magnetic induction only, when one half of the clutch is fixed and the other half revolving at speed, falls off very rapidly and is reduced practically to zero at a speed difference of approximately 1,000 feet per minute. This reduction of torque at high speeds is due to the inherent inertia of the flux lines and their inability to build up to any high value in the time in which a floating tooth is passing under the polar tooth projections.

Inversely, it will be noted that as the speed difference between the two halves approaches zero the torque builds up very rapidly as the clutch halves approach synchronism. One of the unique and novel features of this clutch design is that the magnetic teeth are embedded in and are entirely surrounded by a material of high electrical conductivity. This mass of material moving rapidly in a strong magnetic field has induced in it

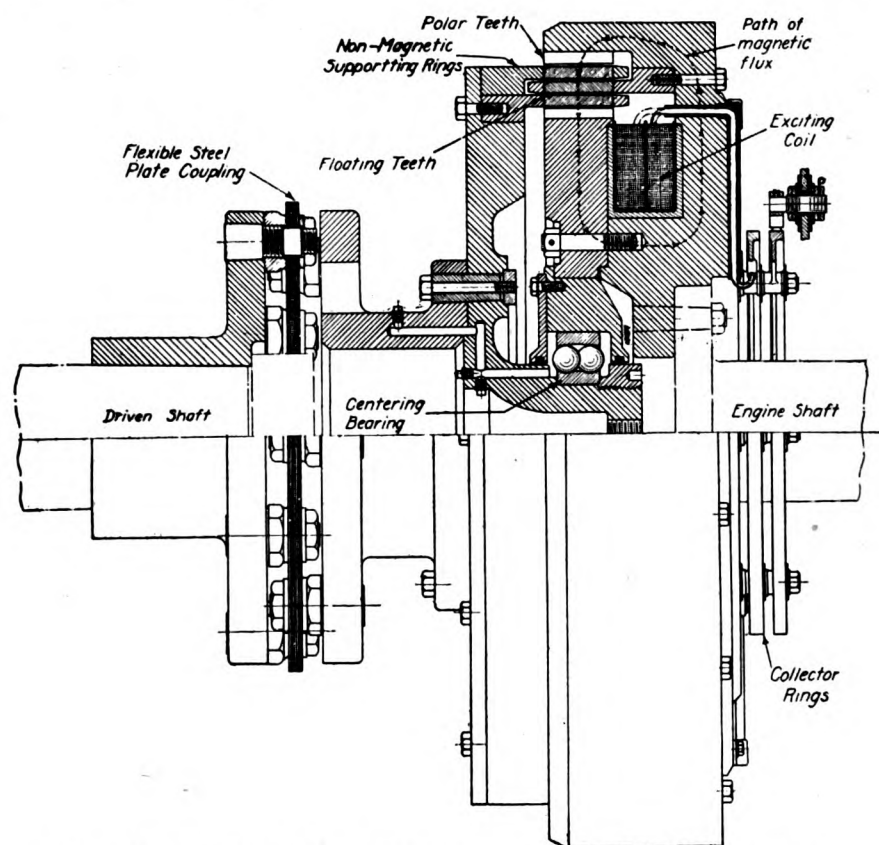


of attainment. In this form of clutch coupling torsional resistance is developed due to the bending or distortion of the magnetic-flux stream passing from the teeth of one polar projection through floating steel-teeth embedded in non-magnetic material and into the teeth on the opposite polar projection.

The component parts of this coupling are so arranged as to enable this distortion of the flux stream to be made in the plane of revolution and a perfect "weight-less" torsional spring is thus provided, see Fig. 1. It will be noted that the magnetic flux passes through the two gaps in series and is thus utilized twice. In this double use of the same flux there is a reversal of the old maxim—"The mill will never grind with the water that has passed."

As there is no mechanical contact in the plane of revolution there can be no shock due to sudden changes in the power transmitted or due to the stretching or failure of the organic material or steel springs as used in the ordinary type of coupling. It will be thus seen that this coupling is a true magnetic coupling and does not depend for its power transmitting capacity through the medium of friction, springs, links, pins, bushings, or other of the old and familiar arrangements which have been known to the art. This clutch has been described as having a "velvet" touch and its nearest analogy is the pneumatic cushion of the type in familiar use on automobiles.

Component parts of the coupling are of an extremely simple form, as may be noted from Fig. 2, all parts being of substantial and rugged form. As there is no mechanical contact in the plane of revolution, the component parts are not sub-



Flywheel type clutch coupling as used with 700 h.p. Diesel engine

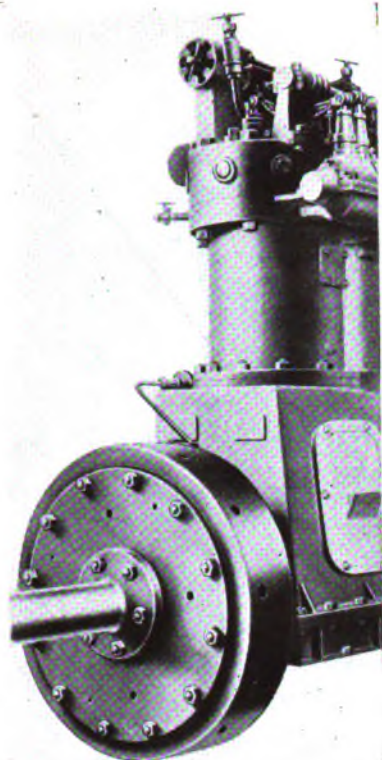
The energizing coil of these couplings consists of a simple circular coil of relatively large size wire which is wound in a form and impregnated with Bakelite. It is insulated to withstand the worst conditions of temperature, dampness and operation. The amount of current required for energizing is extremely small for the power transmitted, as but a few watts are necessary and only a fraction of a kilowatt is required for a coupling of large capacity. The exciting current is led into the coil through a simple form of brush holder bearing on collector rings which are mounted on and form part of one of the coupling elements.

Standard couplings are designed to be operated at a potential of 110 volts, D. C., although exciting coils may be wound for any voltage up to 500. The couplings are adapted only for operation on direct-current circuits and will not operate on alternating-current systems of any voltage.

The clutch is energized by the simple pressing of a button and the driven part is gradually speeded up and brought into synchronism with the driving part. After clutch is synchronized no slipping takes place unless a load is thrown on clutch greatly exceeding its rated capacity. This characteristic may be utilized in many applica-

eddy currents especially in the metal between the teeth, and circulating currents in the metal around the teeth, so that a very powerful drag is developed which is effective as starting torque to get the load in motion. The magnitude of the currents flowing is at any time roughly proportional to the difference in speed between the two halves of the clutch and it will, therefore, be evident that with a larger speed difference the torque developed will be higher on account of the greater current flowing in the conducting material.

This characteristic is extremely valuable in that the maximum of starting torque is developed at the instant or at the time when the static friction or "friction of rest," of the load to be started is the greatest, as, for instance, in picking up a propeller. As soon as the load is in motion and turning over, the torque, naturally, drops off as the speed increases until it reaches a point where the starting torque curve intersects the curve of torque due to magnetic induction only. In practice, this point is taken as approximately the rated capacity of the clutch. From this intersection the torque will be seen to rise very steeply and the load is rapidly accelerated up to synchronous speed.



Clutch installed on engine

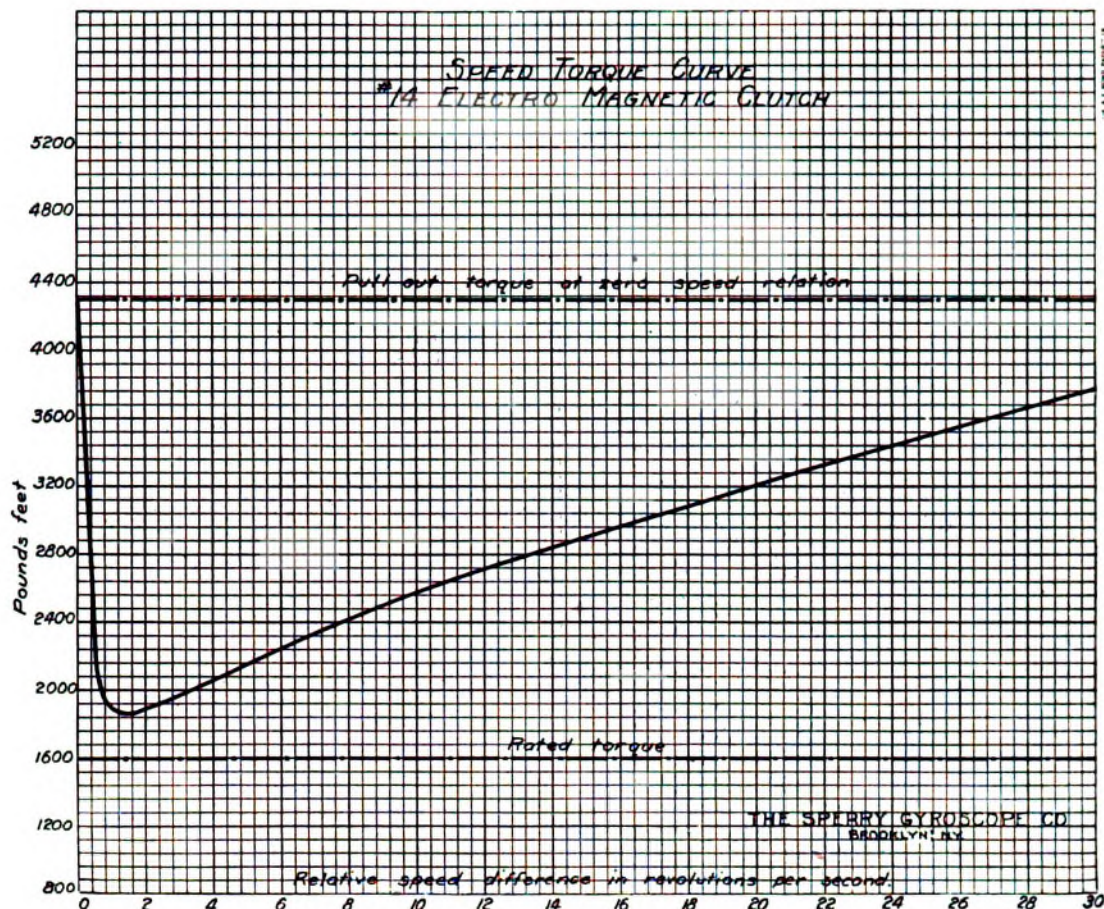
This characteristic, it will be noted, provides a possibility for continuous operation at any speed between zero and the speed indicated by the bottom of the loop in the speed torque curve shown in Fig. 4, it being possible to adjust the exciting current in the coil to a value which will just maintain the magnetic conditions required to pull the load at a definite speed. What this means in a Diesel engine boat can be readily appreciated as the engine can be kept running at its lowest stable speed and manipulation of the clutch will allow of propeller speeds anywhere between zero and engine speed.

It will be obvious that the use of such a clutch will greatly reduce the demands on the air-pressure system and make, therefore, a simplified and cheaper equipment, at the same time greatly increasing the flexibility and maneuvering qualities.

When running under normal conditions, in carrying its rated load, there is no slip whatever between the halves of the clutch and the efficiency of transmission is extremely high. A torque of considerably more than 200 per cent of its rated capacity is required to pull the clutch out of step and this very definite torque capacity at adjustable excitation values may be used as a safety valve in predetermining the exact overload which may be allowed on a shaft system. The efficiency of transmission is very high, as is indicated by the fact that 525 h.p. has been transmitted with a total expenditure in the exciting coil of only 256 watts. This amount of energy is much less than that used to start an ordinary automobile engine. The efficiency of transmission, however is not usually of moment in the solving of ordinary clutch or coupling problems, as the losses due to improper functioning and in the care and maintenance of the average mechanical clutch is such as to make these factors predominate.

This new Sperry type of electro-magnetic clutch coupling is especially adapted to:

- Transmitting power from Diesel or other oil engines.
 - Operating air-compressors, cement and steel mill machinery.
 - Connecting synchronous A. C. motors to their loads.
 - Tandem connection of A. C. generators to source of power.
 - The suppression of critical speed conditions in a shaft system.
 - Transmitting large powers where accurate shaft alignment cannot be a condition.
 - Transmitting large powers where perfect torsional flexibility is a condition.
- This new type of clutch has:
- The velvet touch of the electro-motor without its mass and inertia.
 - Axial freedom for end-play allowance on motors, generators and similar apparatus where same is essential.



Facility for remote control with simplest apparatus.

No parts subjected to mechanical strains, or friction surfaces to wear out.

No parts which are affected in any way by water, oil, dirt or conditions arising from the severest service operations.

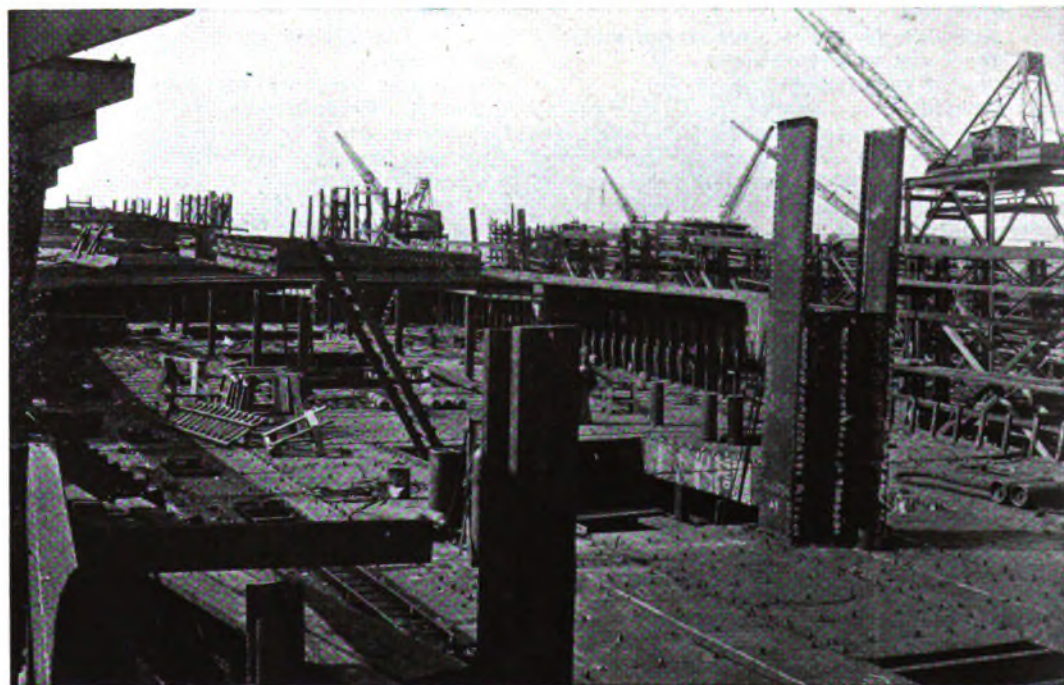
Capabilities of operating at speeds beyond the range of mechanical and other types of clutches.

This company is placing this clutch coupling on the market with the greatest confidence that it will solve satisfactorily many of the vexatious

transmission problems which have confronted mechanical engineers in the past. Problems which have been difficult to solve with the old and familiar means at hand, as the rotational speeds met with in recent years have shown a constant tendency to work to higher magnitudes where the effect of mechanical shock and reaction on the moving mechanisms involved are greatly magnified. Engineers who have witnessed the operation of these clutch couplings have stated that the commercial introduction of this coupling will mark an epoch in the history of the art of power transmission.

CLUTCH CAPACITIES AVAILABLE

Clutch Coupling Number	NORMAL RATING			Max. speed r. p. m.	Max. starting torque at 30 rev. per second speed difference	Amperes Reg. at 110 volts	Approximate Wt. lbs.
	Max Pull-out Torque lb. ft.	Constant Torque lb. ft.	H. P. per 100 rev.				
15	450	175	3.25	3,000	390	1.00	120
7	800	325	6	2,500	780	1.15	265
9	1,300	500	9.0	2,500	1,640	1.25	395
14	4,300	1,600	32	2,000	3,750	1.50	500
18	6,000	2,200	42	1,600	5,000	2.00	1,100
24	10,000	4,500	85	1,200	8,000	3.00	2,200
32	20,000	9,000	170	900	10,000	4.00	4,000
40	40,000	16,000	305	750	15,000	5.00	6,000



Showing present stage of construction of the two motorships of the American-Hawaiian Steamship Co. now under construction at the Chester Yard of the Merchants Shipbuilding Company. Burmeister & Wain type Diesel engines now building at the Wm. Cramp Ship & Engine Works, Philadelphia, will be installed

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed)

STEAMSHIP OPERATOR STUDIES MOTORSHIP QUESTION

July 11, 1921.

To the Editor of "Motorship":

We will probably get into new construction again when business becomes normal and when ship costs reach an attractive level. Prior to this time, I should be very glad to keep in touch with the design, construction and operation of Diesel-engines, inasmuch as we may find it desirable to go into Diesel-engine propulsion.

Yours very truly,

A. S. HEBBLE,

Superintendent-Engineer,

Southern Pacific Company,
Pier 49, N. R., New York.

MOTORSHIPS AND "MOTORSHIP" IN SOUTH AMERICA

To the Editor of "Motorship":

Having just returned from a South American trip I thought it might be of interest to you to know how motorships are regarded in that country and what they think of your magazine.

A good many motorships call at ports on both coasts and shipowners are interested. One owner said they come into port so silently, get their cargo, depart with no fuss and never seem to get any fuel.

I saw your magazine on sale in Valparaiso and several engineers asked me if I had any spare copies. It is unquestionably the authority in South America on all matters pertaining to oil-engines and motorships.

Yours very truly,

HARRY SUMNER.

Seattle, Wash.

ADVANTAGES OF THE DIESEL-ELECTRIC DRIVE APPLIED TO MARINE PROPULSION

To the Editor of "Motorship":

In a recent paper (by Messrs. J. F. Metten and J. C. Shaw) which has attracted considerable attention, the Diesel-Electric Drive system was referred to in rather unfavorable terms. Like the majority of other questions, there are two sides to it, and the ship-owner who contemplates the use of Diesel engines—and there are very many who are always in the van of progress, seriously taking thought of the morrow—should and would carefully consider all the factors before making a decision.

In the selection of the motive power for any vessel, various factors enter into the problem, in about the following order:

- 1st. First cost.
- 2nd. Suitability for the required type of ship.
- 3rd. Space and weight occupied.
- 4th. Cost of operation.
- 5th. Reliability.
- 6th. Life of the installation.

If it were possible to assign numerical values to each of the pros and cons affecting each of the factors it would then be possible to arrive at a definite conclusion free from prejudice and opinion. But unfortunately these factors cannot be so valued excepting where certain definite propositions are put up, one against the other, and where actual experience and data are available. It is to be regretted that at the present time sufficient experience is not available, so the problem reduces itself to a comparison of actual bids and guarantees, together with the exercise of considered judgment and common sense towards any factors not covered by such bids and guarantees.

With the data and experience that has been obtained the following statements may be made relative to the several factors.

First Cost.—The most direct answer to this question is to get bids from the builders of the direct-drive and the electric-drive systems. The New London Ship and Engine Company, whilst ready to bid and build on both systems, has worked in conjunction with manufacturers of electric equipment and is prepared to make bids on the complete electric-drive system. Its estimates and experience to date indicate a slightly cheaper first cost for the electric drive installation. There are two reasons contributing to the above result, one

of which is that the total weight of such an installation is less, and consequently the cost of material is less, and the other is that both the engines and electrical machinery are standard, and so can be manufactured in quantity, thus taking advantage of the well-known saving due to mass production.

A further reason is that it is not necessary for the auxiliary generating units in the Electric-Drive installation to be so numerous or so large as in the case of the direct-drive, for when handling cargo, assuming electric power is utilized as is the case of practically all Diesel installations, one unit of the main engine is used, efficiently and economically, while one, two, or three auxiliary units of fairly large capacity are required for this work when the main engines are direct connected. Add to this that the provision made for supplying maneuvering air and its storage for this type is greatly in excess of that required for starting purposes only of the other type, and that this costs money, it can be readily seen that the cost of main propelling machinery for electric drive includes a large part of the cost of the auxiliary machinery, which is not so included in the first cost of a direct drive proposition.

Suitability of the Machinery for the Required Type of Ship.—The type of ship depends in many cases on the individual preferences of ship-owners, based for the most part on practical experience. A single-screw ship is considered essential by many, partly for the sake of higher propeller efficiency, partly because shipbuilders construct this type more cheaply than that with twin screws, partly to enable decent afterbody lines to be obtained with machinery placed aft, and partly to prevent, so far as possible, damage to propellers when coming alongside. The electric drive is ideal for any or all of the above considerations, as the main engines may be arranged without much regard to position so long as they are in the machinery space, and thus the lines may still be fine without the machinery space being too far forward. Single screws can be used without sacrificing the advantage of having two, at least, similar sets of main engines. Fortunately these same advantages can be obtained when the electric-drive system is installed amidships. At the present time there are many shipowners who would not consider Diesel propulsion, reliable though it has proved to be, unless the vessel had more than one set of machinery capable of operating the propeller. Furthermore, there are very few single-screw installations of the power required for ships of 5,000 tons and above, and for this class once again the electric drive is ideal, as it has practically no limitations as regards power with single screws.

Space and Weight.—The slow-speed direct-drive engine is exceedingly heavy—over 400 lbs. per horsepower. Its over-all dimensions are necessarily large. Therefore a correspondingly large space must be devoted to it. The Electric-Drive system, being divided into a number of smaller units, can utilize spaces not available for the larger engine. The greater the amount of power required, the greater this advantage shows up. [Weights of the 10 leading American slow-speed Diesel engines were given on page 293, April issue, and they average 339 lbs. per brake h.p.—*Editor.*]

Cost of Operation.—This includes many things. It is not only fuel, lubricating oils, and attendance, but in a broad way includes depreciation, repairs, maneuvering ability and reliability. An accident, or a long time under repairs would add enormously to the cost, and make a big hole in the profits at the end of a year. Many of these factors are so great that they would completely absorb a slight difference, say 15% in the fuel bill. There is a tendency to over-evaluate the advantage that exists between a fuel consumption of 0.42 and 0.45 lb. per b.h.p.-hour, and undervalue the claims of simplicity, ease of repairs, and possibility of obtaining any casting or part in the majority of comparatively small engineering establishments in any part of the world. Apart from these considerations, with the smaller electric-drive engines, all identical, the outfit of spare parts will not be much larger than that required for one

engine, so that it is feasible to carry every conceivable part so that every conceivable emergency may be met, without actually carrying so much weight on board compared with the direct-drive larger engine supplied with normal spare part equipment that only touches the high spots, so to speak, of possible replacements.

Repairs to the large direct-drive engine, when they become necessary, are often expensive and should an accident occur in a foreign port and the necessary spare parts not be carried on board, the resulting delay might well run into months, while the electric-drive installation with a similar accident will always be able to make the repair and still operate or, if beyond available resources, can still return to the home port, limping, it is true, but getting there.

To date there have been many types of direct-driven Diesel engines put into service, but only a few have made reputations. The failures were mostly experimental in nature, the products of over-enthusiasm and misplaced confidence. The successes are the products of conservatism and care. The design was exceedingly heavy with few if any untried features and the operating engineers were carefully trained by the builders. It is to overcome these very difficulties that the electric-drive is proposed. The engines being of moderate weight, moderate speed, and simple in the extreme, should not require a very highly specialized or numerous personnel. One engineer and one oiler can give all the attention necessary to an entire group of engines, and the electrician, usually carried in Diesel-engined ships, attends to any electrical upkeep necessary.

The question of reliability is so closely connected with that of cost of operation that it has been fairly well covered in the preceding paragraph. The great reliability of the Diesel-Electric Drive comes from two principal elements, to-wit, the inherent reliability, flexibility and smoothness of performance of electric motors; and from the reliability inherent to multiple units.

Life of Installation.—So far as can now be told, there should be no appreciable difference in the life of the two systems. The wear that will and does take place has two causes, viz.: piston speed and pressure. No matter how large or small the Diesel-engine may be, these two elements remain about the same, and are the same in good design, irrespective of size within wide limits.

The ideal internal-combustion engine would be a machine, absolutely standard, enclosed in a box with a few levers projecting, so that it could be started, maneuvered and controlled under all conditions by the movements of these levers. After a certain period of operation, it would be removed bodily for refit, being replaced by one exactly similar, the original being placed into condition for a further period of service. Connect up some such machines to electric generators and let them furnish current to the main motors and the power problem is solved. Such an ideal machine is not yet in existence, but the Diesel-Electric Drive is a step in that direction and is considerably nearer the goal than the direct-drive especially for powers of the order required for passenger and large freight vessels.

It is fitting that the firm which originated electric-drive also has the longest experience of Diesel-engine direct-drive in the United States, so that it can look upon the question quite dispassionately due to its experience of both types and is not committed to any one type to the exclusion of the other with the enthusiasm that is often born of knowledge of one type only.

Yours very truly,

THE NEW LONDON SHIP & ENGINE CO.

E. Nibbs,

Groton, Conn.

Marine Engineer.

[Through pressure of space we have been obliged to hold-over many interesting letters until our next issue.—*Editor.*]

MOTOR-TANKER "DOEWA," EX MONITOR

Recently at the Panama Canal was the motor-tanker "Doewa," 497 gross tons. This vessel was a light-draught motor-monitor in the British navy, and was lately converted for merchant purposes. She is now owned by the Curacaosche Petroleum Maatschappij, of Curaco, and was built at Middlesboro, England, in 1915. Length 177.3 ft. Breadth 31.2 ft. Draught 12.2 ft. She is propelled by twin 320 b.h.p. Bolinder oil-engines.